AUGUST 1947

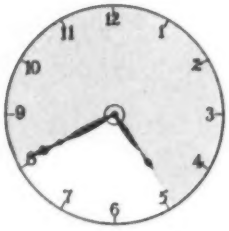
ROCK PRODUCTS

THE INDUSTRY'S RECOGNIZED AUTHORITY

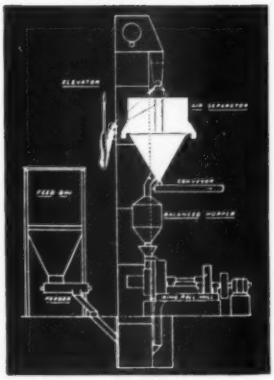
Battery of rotary kilns at the Mobile, Ala., plant, Ideal Cement Co.

STURTEVANT Air Separators

Increase Output up to 300% Per Worker's Shift



Saving time by increasing production results in greater earnings. Sturtevant Air Separators effect worthwhile savings by increasing mill capacities from 25 to 300% . . . cutting power consumption by as much as 50%. They efficiently carry off all classified materials in any desired fineness from 40 to 325 mesh and finer. In addition, their rugged construction reduces maintenance. Look into the tonnage producing, cost reducing Sturtevant Air Separators, today. They are available in capacities from ¼ to 50 tons per hour.



Sturtevant Air Separator in "closed circuit" with pulverizer. This combination increases tonnage and reduces costs in all types of industry.

STURTEVANT MILL CO.

102 CLAYTON STREET
BOSTON 22, MASS.

Designers and Manufacturers of CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS • ELEVATORS • MECHANICAL DENS AND EXCAVATORS • MIXERS

"WE HEAR..."

August 1, 1947

Cost of highway maintenance operations, comparing 1941 and 1945, was up 35 per cent according to a study of the Highway Research Board. Labor was up 42 per cent, materials 30 per cent, equipment rental 29 per cent and overhead 27 per cent according to data compiled from unit costs, weighted to arrive at percentage cost changes.

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Vandals sometimes pick some tough assignments in their desire to do damage. A Kansas concrete products firm recently reported that 200 concrete block in its yard were destroyed overnight.

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Not so many months ago, building completions were being retarded by unavailability of accessories, but the picture is changing. Building hardware makers now are getting order cancellations as certain classifications of construction activity drag.

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Permits for urban building in the first quarter of 1947 were 35 per cent below 1946 and down 54 per cent for non-residential construction, reflecting the reaction toward high prevailing prices. Yet, building costs are likely to get another upward push soon. A New York plasterers' union is asking $3 an hour while, in Seattle, a cost-of-living assessment scheduled for July 1 would have raised all construction workers by 13¢ an hour. If this trend continues, there is danger of choking off home construction even more.

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Home construction activity may not be up to expectations, but loans for the purpose are being actively sought. The F.H.A., in June, received more applications for mortgage insurance than in any previous month in its experience, covering 48,755 new units. The previous high was 43,246 units established in March, 1942. The June figure was more than five times the total for June, 1946.

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Changes in the definitions of executive, administrative and professional employes as used to determine exempt employes under the Fair Labor Standards Act, are likely to be made. The Labor Department is at present reviewing current definitions.

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An employer likely can be required to reinstate a veteran in his old job if he (the employer) bought out the company that formerly employed him, provided the same or a similar job exists in his plant. A recent court order ruled that a returned serviceman is entitled to a cash payment, in place of reemployment, because the new owner refused to reinstate the veteran, who had, in the meantime, secured other employment.

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A returned veteran likely can be placed in a position that pays less than the job he left when he entered service if it can be shown that a decline in business makes it impossible to restore him to his former status.

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Employment and wages were at a new high by midyear but prices were substantially increased with indications that they would stay up at least through the year. Weekly wages, according to the Labor Department, are 3 per cent above the wartime peak even though hours are shorter, but the cost-of-living index was 155.8 (for May 15) as compared with 133.3 in June, 1946.

WE HEAR

An employer probably can refuse to bargain with a union during a strike called in violation of a no-strike contract. In a recent decision, it was held that an employer is not required by the Wagner Act to bargain with strikers under these circumstances.

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The new coal contract may result in a squeeze-out of high cost mines and those turning out inferior coal, once real competition and price-cutting return. Many of those mines are not suited to further mechanization.

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Highway construction in 1947 is showing considerable improvement over 1946. In 1947, the total highway construction expenditure will approximate 1¼ billion dollars as compared to $706,000,000 for 1946. These figures include construction by the federal government, States, counties and cities. Leading States (first quarter) were Texas, Pennsylvania, California, Florida, in that order.

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An employer likely can be permitted to lay off a veteran, who had been reinstated in his former job, if the plant discontinues the particular type of work in which he is employed.

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New homes are being quickly resold by many veterans, based on the fact that 11,000 G.I. home loans thusfar have been repaid in full. Veterans Administration authorities interpret the figures to mean that that number of people would not liquidate 25-yr. mortgages in such a short time if the homes were kept, and that some veterans saw opportunities to make a quick profit. However, it is more likely that many sold their homes because they found they could not maintain them.

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Restrictive practices of building trades unions, including "featherbedding," jurisdictional disputes, excessive union dues and other problems are to be the object of an investigation by the House Labor Committee.

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Building material supplies, generally, are now sufficient to meet all requirements and by the year's end all shortages likely will come to an end. Lumber production has been increased but demand is running high to match the current production rate. Masonry products are close to demand levels, but millwork, hardwood flooring and cast iron radiators still are troublesome items.

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New construction through June, 1947, reached an estimated total of $5,356,000,000 or 40.1 per cent more than for the six months period in 1946. Total new building in June, 10.9 per cent over May, represented more than the seasonable upswing in construction activity.

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Hydrated lime is being used in Great Britain as a carrier for a selective weed killer, made from "methoxone," a complex organic solvent which is the active ingredient. The lime, in this application, also helps to neutralize soil acidity and adds calcium as a plant nutrient.

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State construction contracts under way in Michigan, let on fixed-fee and cost-plus contracts, are proving difficult of control. Labor efficiency is down and the State has no way to insist on adequate production from labor.

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Shortages of other fuels than coal are blocking the escape of coal users from higher prices. Fuel oil will be short next winter and the outlook for gas is even poorer for users who want to convert from coal. However, oil sources are being vigorously tapped and each rise in coal prices makes pipeline transportation of natural gas more economically practical.

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THE EDITORS

★ ★ Editor's Page

A New Age of Long Rotary Kilns

SKY HIGH PRICES of fuel are forcing the portland cement industry into a wave of very long rotary kiln installations that will be the start of a new chapter in the scientific development of cement manufacture.

Hitherto, experience with such kilns (wet process) has been limited to comparatively few cement manufacturers, so new experiences and practical ideas that will develop from operation of the many new installations will contribute immensely to the accumulating knowledge of acceptable practice. Mill operations preceding the actual burning of raw materials into clinker and all the other factors that have any relation to kiln performance will come in for critical study.

Very long kilns, those over 300 ft. and approaching 500 ft., are being successfully operated; they are producing a very acceptable product and at much higher thermal efficiency than in similar short kilns, but their sensitivity—their proneness to get out of firing balance—and load fluctuations challenge the ingenuity of operating men who recognize that maximum capacity, economy and the ultimate in uniformity of product have not yet been attained.

Load Fluctuations

Load fluctuation remains one of the mysteries not yet completely understood. Those who have solved the ring problem, as such, still are concerned with those relatively moderate recurring surges and accompanying intervals of low kiln load that prevent day in and day out uniform capacity production.

Experience has proved that uniformity of all factors relating to kiln operation—firing rate, draft, speed of rotation, rate of feed, feed materials—contributes to regularity of long kiln performance, which is reasonable, but is uniformity the entire answer, or nearly so, and how closely can those factors be adjusted to approach uniformity? What is the ultimate in uniformity of all those items that can be achieved in a manufacturing plant and at what point would a manufacturer stop in attempting to approach perfection? Mechanical equipment and devices are definitely controllable but variables in chemical composition and particle sizes of raw materials are another thing.

It is becoming generally accepted that long rotary kilns be turned at constant speed and with positively synchronized rate of feed, leaving the rate of firing as the variable for compensation purposes. Definite benefits in the attainment of regularity in kiln performance have accompanied the practice. Grinding of raw materials to higher finenesses, 90-95 per cent minus 200-mesh, followed by meticulous blending in order to attain uniformity of composition also have contributed toward solution of the problem.

Feed Material Influence

Other variables having to do with particle size distribution and the chemical and mineralogical characteristics of the several raw materials, however, may be important in the extraction of further non-uniformity from kiln operation and the question is how much can be done, practically, to regulate those factors. Certainly, closed circuit raw grinding is more effective than open circuit milling in achieving uniformity of particle size, but there is no hope of ever grinding diverse materials as laid down by nature to absolute uniformity of particle size.

If uniformity of particle size be deemed of sufficient importance, how close can the range of sizes be regulated? Extremely fine particles that are bound to be present, we assume, will fuse partially before the larger particles do, probably to form a sticky material which might build into ring proportions with repetition, or there might be premature clinkering of the easily fused fractions of raw material resulting from the physical segregation of certain chemical elements. Certainly different forms of silica and other minerals that may exist in the raw materials would be expected to behave differently with calcium compounds at various temperatures in a kiln.

It would likely be impossible or impractical to attain complete theoretical uniformity of chemical composition, taking into account possible different mineralogical forms of the required chemical elements that exist, and it certainly is impossible to attain absolutely uniform particle size, but more recognition of the chemical functions of a kiln and more knowledge of chemical changes that take place inside may prove valuable in furthering perfection of operation.

High rate of speed of kiln rotation, up to 100 r.p.h. or even more, accompanied by a lightened load, is said to contribute to regularity of high production, suggesting that speed of travel, the time factor, contributes to minimization of load fluctuations. Highest possible uniformity of all factors, in combination with accelerated material flow, may give best results.

Bror Nordberg

BEFORE 55-HOLE "NITRAMON" BLAST in southern cement-rock quarry. Well-drill holes averaged depth of 56 feet. Safety and simplicity of loading "Nitramon" speeded operations.

"NITRAMON" BLAST SHATTERS THE FACE . . . produces excellent fragmentation. "Nitramon" is packed in strong, waterproof metal cans . . . may safely be loaded days prior to firing shot.

RESULT OF BLAST shows a nice spread of rock . . . yielding approximately 65,000 tons. "The performance of 'Nitramon' thoroughly satisfies cement company officials," reported Du Pont Technical Service Man on the job.

"Nitramon"—and Du Pont Technical Service—bring an unbeatable combination of safety, efficiency, and economy to quarry operators. Let these two go to work on your blasting problems. Contact the Du Pont Explosives representative in your area for full information. E. I. du Pont de Nemours & Co. (Inc.), Explosives Dept., Wilmington 98, Delaware.

"NITRAMON" is so safe it cannot be detonated by blasting caps, open flame, or even the impact of rifle bullets. Yet a combination of "Nitramon" Primer and Primacord detonated by an electric blasting cap readily fires this safest blasting agent.

DU PONT "NITRAMON" *A Product of Du Pont Explosives Research*

BETTER THINGS FOR BETTER LIVING
. . . *THROUGH CHEMISTRY*

DU PONT

REG. U. S. PAT. OFF.

Rocky's NOTES

Nathan C. Rockwood

Woes From Unstable Dollars

A FRIEND ENTRUSTED with decisions to spend or not to spend millions of dollars for new equipment and machinery in the portland cement industry tells us, "Our problems are not technical, they are economic." "You tell us," he said, "how we can hope to recover new capital expenditures."

The unstable purchasing power of money is the real cause. Had we economic wisdom in high places, every effort would be made to stabilize the purchasing power of the dollar, because the success of our whole economy depends on it. To attempt to stabilize prices, or wages, is to attack symptoms and not the disease, which is too much paper money for a normal value of tangible things. Under our system of paper currency, which is without intrinsic value, governmental evidence or certificates of indebtedness is money—currency. When this represents unretired debt for things bought, and destroyed in war, or things sent abroad without tangibles in return, it simply multiplies the "dollar value" of those things left in this country.

Aware of the constantly lower purchasing power of the dollar, misguided people seek higher money wages, yet all history has proved that higher money wages for less production can never keep up with advancing prices —the cost of living.

Corporation Finance

To be specific, take the problem of our cement company executive. His corporation, like every other well-managed American enterprise, keeps an honest depreciation and depletion cost account. The theoretical purpose of a depreciation, obsolescence and depletion account is to create a sinking fund to reimburse the owners—the shareholders—for their investment in the business when its resources are exhausted or its plant worn out. However, as a matter of business management, such funds are practically never used to liquidate a business. They are used to keep plants modern by constant replacements and renewals. Thus the original capital investment is protected, without having to assess stockholders or to sell new securities; otherwise capitalization would constantly increase as the plant grows old, until the business failed from mere overloaded capital structure.

Let us say that equipment installed ten years ago has been written off, so that approximately its installation cost has been recovered. However, to replace this equipment now with a similar up-to-date installation costs twice the fund provided for renewal, caused by loss in purchasing power of the dollar. Thus, if replacement is made, new capital must be obtained, capital account increased, fixed charges on cost of manufacture increased; and if the product is to be sold at a profit the price must be increased. No producer or manufacturer wants to increase prices unnecessarily because he at least is intelligent enough to see that it only adds impetus to the upward spiral.

Petroleum Industry Spends

Equally important is doubt as to what our dollar will buy ten years hence. If present trends continue the depreciation rate on new equipment installations should be doubled, which, of course, would only accelerate the upward trend in prices and wages Such money spirals have to end sometime. In various European countries these spirals have ended in their paper money not being worth its weight in waste paper; then a new start has to be made with new money tied to something of intrinsic value.

The problem is simplified if there is, or a prospect of, a real shortage of a product. This condition exists in the petroleum industry, and the industry has prepared for it by retaining an extraordinary percentage of its earnings as capital surplus. Labor points to these earnings as reason for higher wages and some politicians, ignorant of economics, suggest taxing these "undistributed profits," but did the petroleum industry not retain these earnings for exploration and development of new sources of supply, there would soon be a country-wide shortage, as even now exists in the Middle West. In spite of the fact that the cost of wildcatting has increased *sixfold* in the last 10 years, and the cost of new and improved refineries has increased *threefold*, the large oil companies are going ahead with capital expenditures of about 2 billion dollars a year for the next ten years.

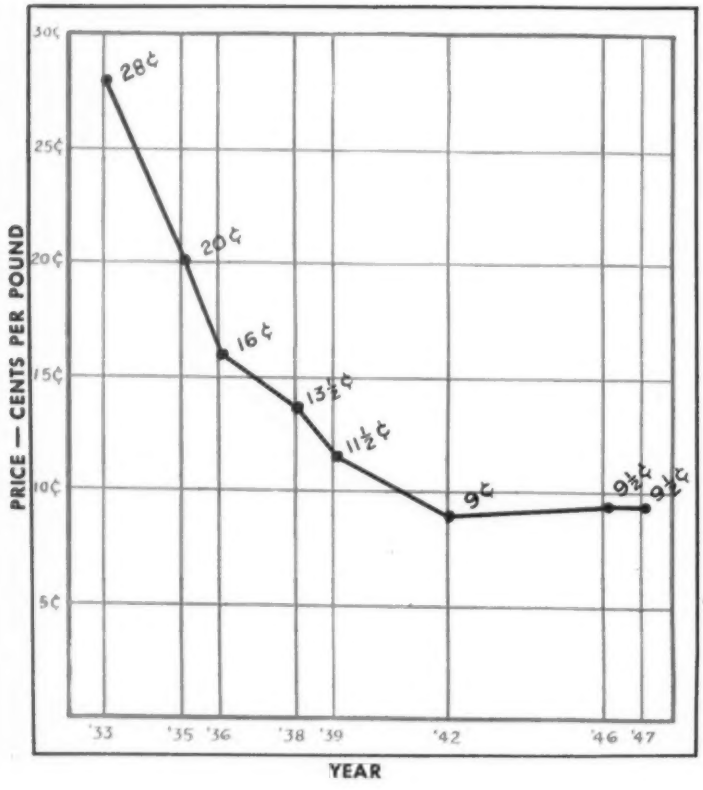
There are three reasons: (1) The demand is there and is bound to grow; (2) today's refineries recover so much more of useful products that a refinery 10 years old is really obsolete; (3) widespread adoption of measures to conserve our national petroleum supplies. A few years ago an oil company developing a new field could expect to get back its investment there in a single year, now with conservation measures it takes several years. Slower capital turnover is true of other industries which require high investment per unit of production. The cement industry used to be able to turn over its capital investment in its annual sales. Now it takes two or more years.

In announcing capital expenditures of $159,000,000 in 1946 and $175,000,000 in 1947, Robert E. Wilson, chairman of the board of directors of the Standard Oil Co. of Indiana, informs stockholders: "The public should understand that our reported profits are based on the *average book costs* of our reserves, more than half of which were discovered a decade or more ago. Our problem is to have enough profit to cover *our much higher replacement costs* and to provide or attract the capital needed to maintain the rate of growth and continued quality improvement that our customers expect of us. . . . The industry will not be serving the interests of either its stockholders or the public unless it insists on getting a fair profit above replacement costs and, for a few years at least, plows back more than half of its earnings, as well as using other available sources of capital, to keep ahead of the demand for its products. Service stations and office buildings can, in general, await the return of more normal construction costs, but the building of refineries and pipe lines and the discovery of more crude reserves must go ahead under forced draft."

Presumably, this heralds increases in prices of petroleum products. The rock products industries' problem is not so clear cut, but the same fundamental factors are there, except that increased prices of cement and other construction materials may further restrict their use, while for petroleum products, there is little prospect that moderate price increases will restrict consumption, which has exceeded all estimates. If the dollar is to continue as unstable as at present, industry should be permitted to write up its book values to somewhere near current dollar replacement cost — then earnings percentages would be judged more fairly; as it is, we are figuring earnings, profits, depreciation, obsolescence and depletion on the basis of 1930 dollars and paying wages and buying equipment with 1947 dollars.

TDA is not a magic wand . . . BUT

A sure way to increase production and reduce finish grinding costs simultaneously is to incorporate the use of TDA in all finish grinding operations. In many mills, the use of TDA can increase production as much as 30%. This means that in the face of rising costs of labor, supplies, and power TDA can and does produce an over-all reduction in unit finish grinding costs.



Mills which have already adapted the use of TDA in all cement are discovering that TDA is paying bigger dividends than ever. The reason is simple because TDA is economically justified—production increases and savings *now!*

The curve shown to the left graphically illustrates the declining price of TDA since 1933. This steady decline is distinctly to your advantage. Our engineers will be pleased to arrange for a trial run of TDA in your own mill.

Dewey and Almy Chemical Company

CHICAGO, ILL. CAMBRIDGE, MASS. OAKLAND, CAL.

Use RDA in raw material grinding if you have a dry process plant

LABOR RELATION TRENDS

Significance of the L.M.R.A. of 1947

By NATHAN C. ROCKWOOD

EVERY BUSINESS PUBLICATION is devoting or has devoted much space to interpreting the Labor-Management Relations Act recently passed by Congress over the President's veto. It seems generally agreed that not much accurate interpreting can be done until we have the results of several years of controversies and court decisions. After some 12 years' experience with the National Labor Relations Act of 1935, we are still getting new and different interpretations.

That being the case, it would seem more important at the moment and more appropriate to a continuing discussion of Labor Relations Trends, to attempt an analysis of the significance of this new law as showing a change in trends. The first point to note is that although the law has a new short title, the stated purpose of the Act is "to amend the National Labor Relations Act." Since the N.L.R.A. is not repealed, it must be assumed that insofar as it is not modified by this new Act, it still holds. This may easily be a cause for controversy in case of conflict in wording.

Findings and Policy

Section 1 of the new Act closely parallels the same section of the N.L.R.A., with this very significant paragraph added: "Experience has further demonstrated that certain practices by some labor organizations, their officers, and members have the intent or the necessary effect of burdening or obstructing commerce by preventing the free flow of goods in such commerce through strikes and other forms of industrial unrest or through concerted activities which impair the interest of the public in the free flow of such commerce. The elimination of such practices is a necessary condition to the assurance of the rights herein guaranteed."

Evidently the wording of this paragraph was very carefully chosen, and it contains the essence of the whole revised Act. No one who has read the newspapers or listened to radio news commentators could honestly disagree with such an obviously truthful and moderate statement. The "rights guaranteed" are labor's rights to collective bargaining, and it is evidently the sincere purpose of the Act, at least to an unprejudiced reader, to safeguard those rights of labor by preventing further abuse.

The next significant thing to be emphasized about the passage of this Act is that labor union officers could be so lacking in intelligence as not to see its inevitability. First, we have the changing character of the decisions of the courts, the N.L.R.B., the arbitrators, constantly, although apparently sometimes reluctantly and slowly, recognizing and restoring the rights of employers. In other words, they were beginning to realize that the N.L.R.A., while emphasizing the rights of labor did not necessarily destroy the rights of management.

Second, we have the example of a half dozen states which hastened to pass "little Wagner Acts"; to adopt state legislation modeled after the national law. These were hailed at the time by union labor leaders as "progressive" states. Most of them have been leaders in social legislation. Hence, when these and other states began to show that they had experienced a sufficiency of such legislation, and began to adopt new "anti-strike," "anti-boycott" and "anti-closed-shop" legislation, he must have been a dumb labor union official who did not sense a turning of the tide.

Third, labor union officials must have been very much out of touch with the sentiment of the rank and file of their membership if they did not know or understand that the real pressure on Congressmen was coming from the ranks of labor. Congressmen, as well as the President, are anxious to be reelected, and no intelligent observer believes they would have voted so nearly unanimously for the Act if they didn't have ample assurance that labor, including union members, really wanted it. The truth seems irrefutable that the majority of labor union members have become tired of being pushed around by self-appointed union officials.

Fourth, the elections last November should have been a clincher to all who follow politics, and that surely is a major obligation of union labor officials, that the tide had actually turned. Hence, by stubborn and uncompromising opposition to any clarification or revision of the Wagner Act, labor union officials lost the one big opportunity they had held for several years to be a constructive influence in the inevitable revision of the Act, and genuine labor statesmen.

Will Mean More Capable Union Officials

The chief significance of the passage of the present Act therefore appears to be a great loss of prestige to present union officials. It is obvious that they staked everything on their own personal desires and an exaggerated opinion of their own personal influence. No doubt this was as obvious to Congressmen as it is to us now. Consequently, these union officials made the mistake of threatening with political forces that Congressmen knew could not be delivered. When the significance of the failure of these labor leaders sinks home, into the ranks of union labor, there is reason to believe we shall see a gradual but persistent demand on the part of the rank and file of labor union membership for more intelligent and capable leaders.

It is quite possible that some union officials realized this too late, which accounts for the last desperate attempts to get the Act vetoed by the president. It seems doubtful from the wording of the veto message that he ever gave the law much careful reading, for in spite of its defects, which responsible Congressmen insist will be corrected in due time, it bears every indication of an attempt to carry out fairly just what the paragraph quoted at the beginning of this discussion, states so carefully.

Much of the revised Act merely legalizes recent interpretations of the Wagner Act, such as the guarantee of the right of the employer to discuss the merits or demerits of a union with his employes. The N.L.R.B. and the courts had already done this. The new Act still prohibits threats and coercion in connection with such talks or writings. It is better, of course, to have these points clarified by law, for experience proved that interpretations could and did change, with changes in the personnel of the N.L.R.B. The new Act is therefore a significant change from administrative law back to legislative law; and that is a very significant change indeed.

Gravel Pit Wins Suit

ESSEX SAND AND GRAVEL CO., Ballardvale, Mass., was found to create no nuisance in a report submitted by Attorney L. F. O'Keefe of Peabody, who sat as master in equity. His draft report finds that the pit has been used for many years, that the machinery used in connection therewith was practically inaudible, and that truck travel over a right of way into the pit raised no dust now that the company had applied a tar surface.

Brick Firm Suit To Be Appealed

STOCKHOLDERS OF THE FORMER WASHINGTON BRICK, Lime and Sewer Pipe Co. will appeal the verdict handed down by the Superior Court that the reorganization by Eric Johnston (president of the Motion Pictures Producers Association) to the new Washington Brick and Lime Co., was legally correct. Judge Frater held that the plaintiffs had shown lack of diligence in their own behalf in failing to bring suit sooner.

Install Gravel Equipment

ED. WACHTER, Big Stone City, S. Dak., installed washing and screening equipment at a plant one mile south of this city.

$2,000.00 Power Saving

WITH THE DOUBLE IMPELLER BREAKER

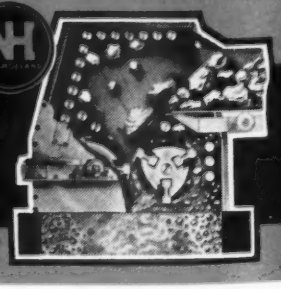
K. U. McCorkle, Milroy, Indiana, checked operating costs for 12 months on his New Holland Double Impeller Breaker. This is what he learned:

"As you know, our Model 3030 Breaker is one of the first you produced. It has been operating steadily ever since installed. Checking our cost per ton for power, we found that, after installing the Model 3030, power savings paid all the maintenance and over $2000.00 beside."

Horsepower for horsepower, Double Impeller Breakers are out-producing conventional machines . . . producing tops in tonnage at less cost.

Write Dept. T-7 today for catalogs on Portable, Semi-Portable and Stationary Breaker Plants.

NEW HOLLAND MANUFACTURING COMPANY
MOUNTVILLE, PENNSYLVANIA



NEW HOLLAND
DOUBLE IMPELLER BREAKERS

PRIMARY AND SECONDARY CRUSHING IN ONE OPERATION

the Personal Side of the news

Named President

WILLIAM D. SPEARS has been elected president of the Cumberland Portland Cement Co., Chattanooga, Tenn. He succeeds Frank Pearson, one of the founders of the company, who has retired after 21 years of service as an officer. Mr. Spears is a member of the law firm of Spurlock, Spears, Reynolds and Moore of Chattanooga, and will continue with his law practice in addition to his new duties.

A.S.T.M. Award

WILLIAM LERCH, manager of the department of applied research, Portland Cement Association, Chicago, Ill., is this year's recipient of the Sanford E. Thompson Award for his paper on "The Influence of Gypsum on the Hydration and Properties of Portland Cement Pastes." This award, which is made to authors of papers of outstanding merit on concrete and concrete aggregates, was presented to Mr. Lerch at the 50th convention of the A.S.T.M. in Atlantic City, N. J.

Assistant Sales Manager

FRED L. WAGNER has been appointed assistant sales manager of the Pittsburgh, Penn., office of the Universal Atlas Cement Co., New York, N. Y. Mr. Wagner has served as sales representative for more than 25 years in western Pennsylvania, West Virginia and metropolitan Pittsburgh.

Injured in Fall

R. F. HERROD, purchasing agent for the Pacific Portland Cement Co., San Francisco, Calif., was hurt in a fall recently while inspecting some surplus material at one of the shipyards in Richmond, breaking his arm and straining the muscles in his hip.

Transferred

R. K. COMANN has been transferred from the Chicago office of the U. S. Gypsum Co. to the company's plant at Genoa, Ohio, as quarry superintendent.

Serves on Water Board

B. E. NEAL, president of the Neal Gravel Co., Mattoon, Ill., has been reappointed for a six year term as a member of the Board of Water, Mattoon, Ill.

Director of Sales

LEE B. GODFREY has been appointed director of sales of the Signal Mountain division of the General Portland Cement Co., Chattanooga, Tenn., succeeding Irving F. Sisson who passed away April 28. Mr. Godfrey has been assistant director of sales for the division since 1945 and has been connected with the construction industry throughout the Southeast for the past 21 years. He was a member of the sales organization of the company in Atlanta prior to transferring to Chattanooga.

Starts Own Business

EDWILL B. SMITH, who was recently appointed general superintendent of Portland Nacional, S. A., Hermosillo, Sonora, Mexico, has severed his connection with that company to open an engineering sales, consulting and service agency in Douglas, Ariz. Mr. Smith has had 30 years of experience in the design, construction, operation and maintenance of cement and commercial stone plants with their allied power systems and will be able to give valuable assistance to these industries.

Edgar Marburg Lecturer At A.S.T.M. Meeting

WALTER C. VOSS, head of the department of building engineering and construction, Massachusetts Institute of Technology, was the 1947 Edgar Marburg lecturer at the meeting of the A.S.T.M. in Atlantic City, June 16 to 20. The subject of Mr. Voss' lecture was engineering laminates which represent the latest development in complex structural materials, embracing a broad field of metals, nonmetals, and bonding agents, that were stimulated by the necessities of war, and the latest problems in complicated fundamental research. The Marburg Lecture, first established in 1925, commemorates the name of the Society's first secretary, who, through his development of technical programs, brought wide recognition to the A.S.T.M. as a forum for the discussion of tests and properties of materials.

Awarded Medal of Merit

BRADLEY DEWEY, president of the Dewey and Almy Chemical Co., Cambridge, Mass., recently received the Medal of Merit for his outstanding services to the United States first as Deputy Rubber Director and then as Rubber Director, and for his services as chairman of the Guided Missiles Committee of the Joint Chiefs of Staff. The award was made by Rear Admiral Morton L. Deyo, U.S.N., Commandant of the First Naval District, in behalf of the Secretary of the Navy.

Executive Vice-President

JAMES P. MARGESON, JR., vice-president in charge of the mining and distribution of potash for the International Minerals and Chemical Corp., Chicago, Ill., has been elected executive vice-president of the company. EDWARD D. MCDOUGAL, JR., who has been a partner in the law firm of Sidley, Austin, Burgess and Harper, has been named secretary and general counsel.

Starts Concrete Business

CARL H. PERSON has resigned from the Crown Sidewalk and Block Co., Minneapolis, Minn., after 23 years of service, in order to start his own concrete business.

Ideal Appointments

FRANK N. PRICE has been appointed labor relations manager of the Ideal Cement Co., Denver, Colo., and VIRGIL

Victor J. Azbe, authority on lime manufacture, visits the Calaveras Cement Co., on a recent trip to California

C. BARTLETT has been made chief chemist of the Union Portland Division at the Devil's Slide, Utah, plant. Mr. Bartlett has been in charge of the research laboratory under Mr. Wilsnack's direction for the past three years and succeeds A. E. Lucas, who is retiring on a voluntary pension after many years of service as chemist at the Devil's Slide plant.

Receives Award

KARL P. BILLNER, president of the Vacuum Concrete Corp., Philadelphia, Penn., and inventor of the process for the manufacture of vacuum concrete and vacuum lifts used in the manufacture of reinforced concrete pipe, bridge slabs and other structural units, has been named winner of the Frank P. Brown medal by Franklin Institute in consideration of his invention. An article about this process appeared in the June, 1946, issue of ROCK PRODUCTS under the authorship of M. W. LOVING.

Receives Citation

DR. M. M. LEIGHTON, chief of the State Geological Survey, Urbana, Ill., has received a citation from the State University of Iowa as a "distinguished alumnus," in recognition of his achievements in the field of geology and for his contributions to the public welfare. Dr. Leighton received his Bachelor of Arts degree from Iowa in 1912, at which time he won the Honorable Frank O. Lowden prize in geology. The following year he received the Master of Science degree from his alma mater and, in 1916, the Doctor of Philosophy degree from the University of Chicago.

Visitor from Brazil

G. J. WALTER of Pedreira Morro Grande, Ltd., Sao Paulo, and also with Walter & Irmao, Sao Roque, Estado de Sao Paulo, Brazil, was a recent visitor to the offices of ROCK PRODUCTS. Mr. Walter heads one of the largest crushed stone companies in Brazil. He plans to study our methods of operation and to visit plants and quarries in the Middle West and the East.

Quarry Superintendent

R. K. COMANN has been transferred from the Chicago office of the U. S. Gypsum Co. to the company's plant at Genoa, Ohio, where he will serve as quarry superintendent.

Assists Engineer

GEORGE M. HENRY, formerly with H. E. Millard Co., Annville, Penn., has joined the staff of L.I.M.E., Hershey, Penn., as assistant to W. R. Cliffe, consulting engineer.

Association Vice-President

NEAL R. FOSSEEN, president and general manager of the Washington Brick and Lime Co., Spokane, Wash., has been elected a vice-president of the Association of Washington Industries.

Retires

JOHN HOMER HUNT, secretary of the International Minerals and Chemical Corp., Chicago, Ill., has retired after 35 years of service with the company.

OBITUARIES

JOHN J. WALLACE, long associated with the talc industry in the New York area, died recently at his home in Gouverneur, after an illness of several months. He was 80 years of age. Until his resignation in 1941, Mr. Wallace was in charge of all properties of the International Pulp Co. (now the International Talc Co.) including affiliated companies. He started his career with the Agalite Fibre Co. and two years later became affiliated with the St. Lawrence Pulp Co. located where the No. 3 mill of the International Talc Co. now stands. Subsequently he was made foreman and then superintendent. When this company was taken over by the International Pulp Co. in 1893, he severed his connections to become foreman of the United States Talc Co. mill which was located at Hyatt, then known as Dodgeville. In 1901 the Union Talc Co. was formed and Mr. Wallace became assistant superintendent and then superintendent. This organization and the U. S. Talc Co. were acquired by the International Pulp Co. in 1906. Mr. Wallace maintained his position. Upon the resignation of A. J. McDonald in 1912, Mr. Wallace took charge of all properties.

WILLIAM J. SMITH, president of the Eastern Concrete Pipe Co., Hamden, Conn., passed away suddenly at his home on June 8. He was 45 years old. Mr. Smith was also a part owner of the Meriden Washed Sand and Stone Co., Inc., Meriden, Conn.

JAMES M. HAMILTON, owner of the J. M. Hamilton & Sons stone quarry at Marion, Ohio, passed away recently after a short illness. He was 80 years of age. Mr. Hamilton started the business in 1906 and operated it with his two sons.

THOMAS EDISON DEMOREST, manager of Criss and Shaver, sand and gravel contractors, Charleston W. Va., passed away June 3. He was 43 years old.

Sand and Gravel Co. Sold

SPOKANE SAND AND GRAVEL CO., Spokane, Wash., including the Irvin and Riblet plants, has been sold to Warren Drollinger for $53,700 by Rex Gillogly. Mr. Drollinger was previously associated with the Acme Sand and Gravel Co., Spokane. With the contract, leases from the Inland Empire Co., and others for the sand and gravel pits, trackage, bunkers and loading facilities were also assigned. The seller retained rights to all sand and gravel now in stock piles.

Regional N.S. & G. Meeting

NATIONAL SAND AND GRAVEL ASSOCIATION regional membership meetings have been resumed. These meetings have two ends in view: to discuss matters of particular interest to the industry both nationally and locally; and to allow members of a particular area to become better acquainted than they would in annual meetings of a national scope.

One of these meetings held recently in Chicago was comprised of two parts, with a talk by Vince Ahearn, executive secretary, reviewing both general problems facing the industry and the Taft-Hartley bill. Both sections were followed by a round table discussion.

The five points discussed under the head of general problems were the future of building, the car shortage as a number one problem in the sand and gravel industry, freight rates and their proposed increase, the bookkeeping system for determining costs being worked out by both this association and the National Ready Mixed Concrete Association (uniformity but not conformity!), and lastly, the need of the two associations for a public relations director. The second half of the meeting, concerning the Taft-Hartley act and its effect on the industry, was led by Mr. Ahearn with a full description, section by section, of the bill. The terms were interpreted and defined particularly for the sand and gravel industry. In the lengthy discussion that followed, the Portal to Portal Act (of 1947) and the Wage and Hour laws also were discussed.

This meeting, following a luncheon, was attended by about 45 members and guests and was presided over by R. E. Weaver, general manager, Lincoln Sand and Gravel Co., Lincoln, Ill., and president, Illinois Sand and Gravel Association.

Change of Address

MARBLEHEAD LIME CO. has moved its general offices in Chicago from North LaSalle street to 2116 Mallers Building, 59 East Madison street, Chicago 2, Illinois. This move enables the company to take over larger quarters.

Suit to Restrain Blasting

WHITEHALL CEMENT MANUFACTURING CO., Cementon, Ohio, is defendant in a suit brought by the Northampton borough council in an effort to restrain the company from heavy blasting. The borough alleges that much damage to real property has been caused by the blasting.

No Collective Labor Problems

National Crushed Stone directors decide against association activity in labor relations

THE MOST INTERESTING and spirited discussion at the summer meeting of the Board of Directors, National Crushed Stone Association, Hot Springs, Va., July 3, was entirely "off the record," and concerned the question of whether or not the Association headquarter's staff should extend its activities into the field of aiding members to meet union-labor collective bargaining problems. This sort of association activity has become common in many industries, including sand and gravel and ready-mixed concrete, with which several members of the Board of the National Crushed Stone Association are familiar from membership in one or both of the other two Associations.

The suggestion was voted down after a frank discussion by nearly all the directors present, apparently, largely because of distrust that any step by the Association to enter into the solution of the labor relations problems of any member would sooner or later amount to a step toward industry-wide, collective bargaining. Since numerous crushed stone companies continue to have satisfactory relations with their employes without the necessity of entering into union labor contracts, it was considered best not to make an issue of such association activity at this time.

Research and Engineering

A. T. GOLDBECK, engineering director, reported progress and developments in connection with his laboratory and field work. The laboratory work at present is somewhat handicapped by moving operations, from its location of many years past to a new site and building, which offers greatly improved facilities. Field work included cooperation with the Connecticut State Highway Department, the Public Roads Administration and the National Sand and Gravel Association in tests of air-entraining concrete and its resistance to freezing and thawing. Mr. Goldbeck said, while he could not reveal test values, the results were very favorable to stone.

Air Entrainment Improves Limestone Sand

Of particular interest are the following two paragraphs from Mr. Goldbeck's report: "In one of the States limestone sand has been dropped from use in concrete pavements due to serious scaling and surface disintegration, accelerated by the use of salts for ice removal. Since air entrainment in the concrete is now being used, the question has arisen as to whether the State would not be warranted in again using this particular limestone sand. A rather complete series of concrete tests has been under way, including an excellent natural sand as well as the limestone sand being investigated.

"When no air entraining agent is used, the limestone sand concrete does not withstand freezing and thawing in the laboratory, while the natural siliceous sand concrete shows considerably higher durability. This laboratory result checks with service behavior. On the other hand, the use of air entrainment in the limestone sand concrete has very greatly improved its durability even when frozen in a calcium chloride solution. Thus far, therefore, the indications are that the durability of limestone sand concrete is vastly improved by air entrainment and it may be reasonable to believe that other fine aggregates hitherto unsuitable may become sufficiently durable for use in pavements. These tests are being continued so that the final results may be more conclusive."

Other laboratory work included tests of mineral fillers for use in bituminous concrete and tests to determine "bulk" or "apparent" specific gravity in connection with bituminous concrete calculations.

Efficiency of Churn Drilling

Not much work done by Mr. Goldbeck's laboratory probably has direct bearing on the efficiency of crushed stone operations, but the following paragraph from his report suggests something that would: "Another idea was investigated as the result of a Bureau of Mines paper by Jack Thoenen on 'Churn Drilling.' It was shown in the paper that, considering the churn drill as a crusher, its efficiency was very low, due in part to the fact that the drill falls through a rather viscous mud and, hence, acts more or less like the plunger of a pump. It does not have a free fall. The thought suggests itself that if compressed air were introduced at the time of ascent of the drill, the mud might be raised temporarily so that the drill might then have a free fall. This idea was tried on a small scale in the laboratory using a small bit and although the tests were crude and merely exploratory they showed that a much harder blow was struck when the mud was gotten out of the way momentarily by the use of compressed air. Sometimes radical ideas actually do work and may be worth a trial on a full scale test."

Bituminous Concrete Research Important

"As I see the immediate future," said Mr. Goldbeck in conclusion, "in the main, our research field will be in bituminous concrete. Durability of bituminous concrete is a very important problem and the problem of developing mixes of the highest stability is becoming increasingly important for certain conditions such as at bus stops. We hope to do effective work on both of these problems as well as on others including air entrainment and stone sand in concrete."

J. E. GRAY, field engineer, reported in some detail his work in the field and his contacts with producers, engineers and constructors. Typical of the kind of work the Association is asked to do for its members, even in relatively flush times when producers are chiefly concerned with filling orders, he listed the following:

The use of "bulk" or "apparent" specific gravity in calculating the quantities of stone or slag for bituminous construction.

The determination of the suitability of a particular stone for the manufacture of filler for use in dense asphaltic concrete.

The determination of the amount of screenings that can be blended with natural sand to produce a workable concrete meeting the strength requirements of the State Specifications.

One quarry has stone that is quite variable and under expanding markets information was desired on the amount of variation in quality and the effect of this variation in respect to the stripping of asphalt.

Further researches on stone sand to the end that proper specifications may be written.

The development of a correct method of test for fineness of rock dust for mine dusting is another problem.

Two general problems in which technical information is wanted are: (1) The relative merits of crushed stone and gravel in bituminous concrete and surface treatments; (2) The relative merits of crushed stone traffic bound roads and soil cement roads.

Mr. Gray concluded his report with the suggestion gained from his field contacts with producers, that more of the time of the annual conventions be devoted to free-for-all discussions of operating problems and practice. The discussion which followed this suggestion showed that others were thinking along the same line. However, a specific request for two afternoon sessions for operating men was not acted upon definitely by the directors, but was referred to the program committee to see what could be accomplished.

(Continued on page 99)

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INDUSTRY News

Complete War-Delayed Warehouse

STARTED BEFORE THE WAR, a new warehouse of concrete block construction measuring 32- x 100-ft. has just been completed by Steward & Silver, Columbus, Ohio. The new structure will be used to store mortar cement, lime, steel windows, and other builder's supplies. The company has added two new flat bed trucks for expediting delivery of block and other materials: a 2-ton Mack and a 1¼-ton GMC. Deliveries are made in a radius of 50 miles from the plant.

Rather than expand its present facilities, the company is considering adding a second shift in the block plant in order to meet the increased demand for light-weight aggregate block (the aggregate used by the firm, Slag Lite, is delivered by rail in hopper-bottomed cars from the Cleveland Slag Co., Cleveland, Ohio). These blocks average 5 lb. lighter for the 8- x 8- x 16-in. size, according to Mr. Wiles, general superintendent.

Long Kiln Ready for Production in Florida

HOOKER'S POINT plant of the Florida Portland Cement Division of the General Portland Cement Co. (Chicago) was the scene recently of the arrival of a 12- x 420-ft. kiln, weighing 2,000,000 lb., which was transported from Canada on nine flat cars. Purchase and installation of the kiln is part of the company's $1,250,000 expansion program. The new kiln will produce as much as the three 176-ft. kilns now in operation at the plant, and will enable the company to produce 3,000,000 bbls. of cement annually.

Quarry Reopened

BEU & SONS CO., Grundy Center, Iowa, have reopened a limestone quarry at Conrad, where operations were abandoned over two years ago. The company also has a quarry in operation in German township and is building up a stockpile of road stone to meet a county contract for 10,000 tons. Agricultural limestone is produced at both quarries.

Northwest Building Boom

LARS CARLSON, SALES MANAGER FOR WASHINGTON BRICK AND LIME CO., Spokane, Wash., pointed out in the keynote address before the 26th annual retail credit conference of the Pacific Northwest at Vancouver, B. C., that the rate of industrial building in that area is now three times as great as elsewhere. He went on to say that the construction market for houses, factories, stores, offices, hotels and commercial buildings would run into billions of dollars.

Proposed Dredging Delayed

BUFFALO GRAVEL CORPORATION, Buffalo, N. Y., has been delayed in starting to dredge 250,000 tons of sand and gravel from Strawberry Island in the Niagara River, New York state, by a hearing before the U. S. Engineers, while a transcript of the proceedings will be sent to the Chief of Army Engineers, Washington, D. C. E. B. Maloney, vice-president of the company, stated before the board that a War Department permit for the work had been issued. The dredging was contested by members of various fishing and sports clubs, as well as the state Department of Health.

Cement Plant to Close

PENNSYLVANIA-DIXIE CEMENT CORP., New York City, will close its Portland Point (New York) plant as unprofitable, according to A. H. Bostwick, industrial relations director. He further stated that it was undecided at the present time just what disposition would be made of the properties. Many elements are reported to have entered into the decision to close the plant, chief among them being the inability to obtain new machinery and sufficient skilled labor.

Opens Quarry

PERRY JONES, Overbrook, Kans., is opening a new crushed stone operation a mile northeast of town. When the new quarry is in production the old quarry (four miles south) will be abandoned.

Cement Mill for Pacific Northwest

COLUMBIA PORTLAND CEMENT CO. (formerly the Washington-Idaho Lime Products Co., Orofino, Idaho) will build a cement mill costing $800,000 in Spokane, Wash. The new plant will have a capacity of 1500 bbls. daily, Otto C. Frei, president, announced recently. The company will sell its plant at Orofino, Idaho.

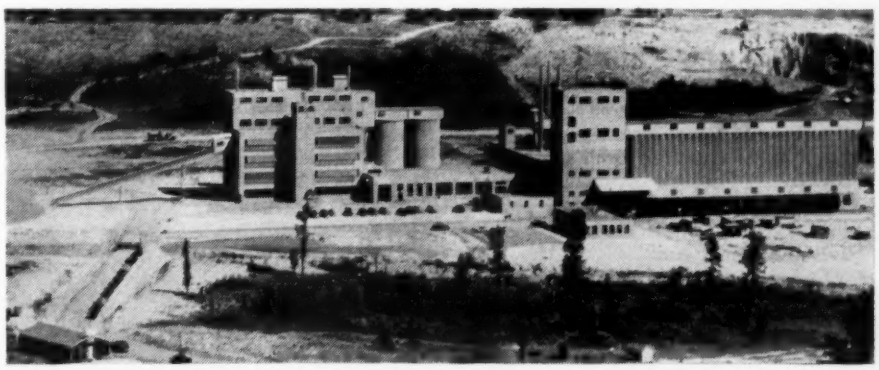
Ohio Marble Expansion

IN LINE with the new packing building and trackage for additional and smoother material flow in its Piqua, Ohio, plant, the Ohio Marble Co. has added a Hardinge Ruggles-Cole dryer, with capacity ranging from 40 to 50 t.p.h., depending on the moisture content of the material being processed. To feed the dryer, a Bradley pulverizing mill of 40 to 50 t.p.h. capacity has also been added, powered by a 300-hp. synchronous electric motor. The dryer is powered by a 30-hp. motor. In order to keep this new equipment and packing plant busy, additional primary crushing plant capacity is being studied.

Ready Mix Plant Opens At Juneau, Wisconsin

BEAVER GRADING CO., organized in 1944 as a grading company, has just completed a ready mixed concrete plant. The new plant is reported to be the first in this vicinity, and uses six transit mix trucks for deliveries.

Officers of the Beaver Grading Co. are: Albert Kaepernick, Beaver Dam, president; Rueben Kuntz, Juneau, vice-president; Kurt Bleck, Beaver Dam, secretary; and Lavern Kohn, Juneau, treasurer.



New roofing granules plant of Minnesota Mining & Manufacturing Co. at Little Rock, Ark. It will have a capacity of 200,000 tons annually, and the cost of the plant was nearly $3,000,000. Other plants of the company are located at Wausau, Wis., and Copley, Ohio

Convention Exhibit Arrangements

L. W. SHUGG, who for many years handled the conventions and exhibits for the National Sand and Gravel Association, National Ready Mixed Concrete Association and the National Crushed Stone Association, through the courtesy of General Electric Co., has retired from the company but will continue to serve in the same capacity on a fee basis. The Exhibit Committee consists of H. C. Peters, T. L. Smith Co., chairman; Kenneth Lindsay, Iowa Manufacturing Co.; and Wayne W. King, W. S. Tyler Co.

The 1948 convention and exhibit of the Associations, as listed in the "Coming Conventions" section of this issue, will be held at the Netherland Plaza, Cincinnati, Ohio, for two consecutive weeks beginning January 19, 1948.

There will be no exhibit in connection with the convention in 1949 which will be held at the New Yorker Hotel, New York, N. Y., beginning the week of February 7, 1949, through the week of February 14, 1949. The meetings at this convention are planned as follows: First week, National Crushed Stone Association, Agricultural Limestone Division; second week, National Sand and Gravel Association and National Ready Mixed Concrete Association.

It is probable the 1950 convention and exhibit will be at the Palmer House in Chicago and the 1951 convention in New Orleans, La., February 11 to 15, 1951.

Semi-Trailer Units for Underground Quarrying

COLUMBIA QUARRY CO., St. Louis, Mo., recently purchased six 16-cu. yd. hydraulic end-dump semi-trailers specially fabricated by the Landis Steel Co., Picher, Mo. The units, designed by M. B. Landis, general manager, have no springs to reduce height and carry but a single 18- x 24-in. tire in the rear instead of duals, thus reducing width and allowing the larger tire to absorb shock in place of springs. A twin hoist is used in the hydraulic system for dumping.

New High for Sales

INTERNATIONAL MINERALS may have set new high records for both sales and earnings in the fiscal year ending June 30, 1947, according to Louis Ware, president, in a letter accompanying dividend checks. Previous high, for period ending June 30, 1946, equalled $3.92 a share.

Plan to Recapitalize

CALAVERAS CEMENT CO., San Francisco, Calif., has declared effective through its directors the plan of recapitalization approved by stockholders. Under the plan, holders of each share of 7 per cent preferred who surrender it, together with the right to accrued dividends, will receive $100 face value 4½ per cent cumulative income debentures, one share of $50 par value prior preference stock and $3.25 in cash.

Stone Crushing Operation

WINFIELD STONE CO., Winfield, Kans., has started operation at a limestone deposit situated on a hill north of town. Agricultural limestone is the principal item produced, and the company owns five limestone spreaders. Rock blasted from the face of the hill is loaded into end-dump trucks by two ¾-cu. yd. shovels for haulage to the primary jaw crusher hopper. A hammermill is used for secondary crushing. The plant is reported to have cost in excess of $125,000.

Coming Conventions

Agricultural Limestone Division of National Crushed Stone Association, 3rd Annual Convention, Netherland Plaza, Cincinnati, Ohio, January 29-30, 1948.

American Concrete Pipe Association, 40th Annual Convention, Hotel Roosevelt, New Orleans, La., March 11-13, 1948.

American Road Builders' Association, Exposition of new Construction Equipment, Soldier Field, Chicago, Ill., July 16-24, 1948.

California Associated Concrete Pipe Manufacturers, Fall Meeting, Bakersfield, Calif., October 24-25, 1947.

National Crushed Stone Association, 31st Annual Convention and Exposition, Netherland Plaza, Cincinnati, Ohio, January 26-28, 1948. Exposition January 26-30.

National Industrial Sand Association, Fall Meeting, Grove Park Inn, Asheville, N. C., October 1-3, 1947.

National Ready Mixed Concrete Association, Directors' Meeting, French Lick Springs, French Lick, Ind., August 12-14, 1947.

National Ready Mixed Concrete Association, 18th Annual Convention, Netherland Plaza, Cincinnati, Ohio, January 21-23, 1948.

National Sand and Gravel Association, Directors' Meeting, French Lick Springs, French Lick, Ind., August 12-14, 1947.

National Sand and Gravel Association, 32nd Annual Convention, Netherland Plaza, Cincinnati, Ohio, January 20-22, 1948.

Bethany Falls "Limestone Day"

L. W. HAYES, INC., BETHANY, Mo., supplied the quarry and quarrying demonstration as background for the local Chamber of Commerce sponsored celebration stressing the importance of limestone to the farmer and also its importance, locally, as an industry. The program, with quarrying, crushing and screening operations; plus talks by important agricultural leaders of the district, took the entire afternoon. The evening was given over to street dancing.

Senate Restores AAA Appropriation

A CLOSED DOOR SESSION of Senate appropriations subcommittee voted to restore more than 225 million dollars to the annual agricultural appropriation. The increase will bring to 300 million dollars the sum for benefit payments to farmers complying with the administration's conservation and use program, which includes the spreading of agricultural limestone. This favorable action by the subcommittee presages well for the final acceptance of the program.

Quarry Resumes

FULTON QUARRIES CO., a subsidiary of Inter-City Quarries, Kansas City, Mo., has begun operation of a mine sub-leased from Mr. and Mrs. Monroe Glenn, former operators of the property located about three miles south of Fulton, Mo. Four tunnels have been started, with the deepest one back about 50 ft. Using a portable crusher, the company produces gravel, concrete aggregate, chat and lime. H. B. Pollock is general manager.

Replacements for Keystone

KEYSTONE SAND AND GRAVEL CO., Dayton, Ohio, has added two pieces of basic machinery in the plant's material flow. One is a new air-controlled Marion 362 Diesel powered dragline with a 1½-cu. yd. Page bucket; and the other is a 3-ft. Symons cone crusher with 75 t.p.h. capacity at ¾-in. discharge.

Lone Star Contract Awarded

LONE STAR CEMENT CORP., New York City, has let contract to Bernard & Byrd, International Building Co., for excavation and pile foundations for plant at New Orleans, La.

(Continued from page 95)

J. R. BOYD, administrative director, reported on progress in establishing quarters in the new building to house the offices and laboratory of the Association, which was recently purchased by the Association.

Mr. Boyd reviewed developments in the construction industry, saying that the dollar-value of building and construction this year would evidently fall short of expectations by perhaps 30 per cent. However, the amendment to the Federal Aid Highway Act, signed by the President June 21, 1947, lengthening to two years the period in which the States may take up their annual allotments, has greatly improved the prospects of a stabilized program of highway improvement.

Percentage Depletion

A considerable part of Mr. Boyd's report was devoted to a resumé of the work of a special committee of the industry which has been seeking for several years to have the Internal Revenue Act of 1942 amended to include limestone, or at least high-calcium chemical limestone, with coal, oil, fluorspar, and other relatively scarce minerals in Section 114 (b) (4) whereby percentage depletions of deposit values are allowed. A following discussion of this showed that there is small chance of the success of this project, regardless of its merit. The provisions of the Revenue Act allowing percentage depletion of coal, oil, etc., expired six months after the end of the hostilities, but a pending bill in Congress, if passed, would reinstate the provision.

Other recent Congressional legislation, and pending bills, were reviewed briefly.

Directors on Hand

The following directors answered the roll call:

G. A. Austin, chairman, W. M. Andrews, L. J. Boxley, J. Reid Callanan, Bruce S. Campbell, W. N. Carter, T. C. Cooke, F. O. Earnshaw, Arthur F. Eggleston, Otho M. Graves, R. G. L. Harstone, H. C. Krause, J. C. Lauber, M. E. McLean, V. C. Morgan, H. E. Rainer, Russell Rarey, J. A. Rigg, James Savage, F. W. Schmidt, Jr., O. M. Stull, Stirling Tomkins, W. H. Wallace, W. S. Weston, Jr., D. L. Williams, W. F. Wise, A. L. Worthen; representing the Agricultural Limestone Division, S. P. Moore; representing the Manufacturers' Division, R. C. Johnson, J. B. Terbell.

Coming Meetings

The 1948 annual convention will be held at the Netherland Plaza Hotel, Cincinnati, Ohio, January 26-28, inclusive. There will be an exhibit in cooperation with the National Sand and Gravel Association, whose convention will be the preceding week. The mid-year meeting of the Board in 1948 will probably be held at the Edgewater Beach Hotel in Chicago, Ill., although that was not definitely decided.

No Unity for Agstone Groups

IN SPITE OF sincere efforts to combine the two national groups of agricultural limestone producers, little real progress has been made to date, according to S. P. Moore, chairman of the Board of Directors of the Agricultural Limestone Division of the National Crushed Stone Association, meeting at Hot Springs, Va., July 4. Committees of this Division and of the National Agricultural Limestone Association have met and discussed possible consolidation, but there appear to be two leading obstacles at present. Both groups appointed representatives to appear before the agricultural appropriations committee of the U. S. House of Representatives to protest the reduction of funds for the Soil Conservation Service, but the philosophy of the two organizations is somewhat different.

The second obstacle to a consolidation at this time is the fact that it would appear to require the assumption of commitments made by one or the other group, which neither group is financially capable of absorbing at the moment. Thus, while both are equally interested in maintaining the federal government's help in keeping the soil conservation and soil liming program active, their policies and methods of financing the project are quite different. From the point of view of the National Agricultural Limestone Association, as given in the discussion, some of its influential members, for reasons not disclosed, do not wish to affiliate with the National Crushed Stone Association. One possible reason is that some are exclusively agricultural limestone producers and make no commercial crushed stone. However, there are many producers of agricultural limestone, exclusively, who are already in the Division of the National Crushed Stone Association.

Education and Promotion

Both Chairman Moore and Henry A. Huschke, managing director, made it plain that the aim of the Agricultural Limestone Division of the National Crushed Stone Association, is to concentrate most of its energies on a continuous educational and promotional campaign to sell farmers both directly and indirectly on the necessity of frequent and generous applications of limestone. It is assumed that in spite of all that may be done to continue federal aid for soil conservation, eventually the farmer will be compelled to rely mainly on his own resources—financial, educational and public-spirited. Hence, the policy of the Division appears to be on a sounder basis than that of a group which places its main reliance on government subsidies.

In his report to the directors, Mr. Huschke reviewed the work of the committee which appeared before the House of Representatives' Subcommittee on Agricultural Appropriations. The fundamental difficulty, of course, is that the present Congress is out to cut as much as possible from the Administration's proposed budget, and in general probably, the agricultural limestone producers as well as most other business men are in favor of reducing the national budget. That an exception should be made in appropriations for farmers, under present conditions, is hard to see for Congressmen, predominantly from cities, where high prices for food prevail. The only logical argument is that the appropriation is not for the present tillers of the soil, who seem quite capable of taking care of themselves, but for the conservation of the soil for future generations.

Mr. Huschke has done a remarkably effective job of institutional advertising and promotion through interesting country bankers in liming programs. These bankers are using advertising copy prepared by the Division in local newspapers in all parts of the country. He has also aided in advertising and radio programs of local groups of producers. A part of his present plans is to help individual producers prepare advertising and promotional programs especially suited to their local conditions. All this has been helpful in attracting new members, and it is estimated that the 229 active members of the Division now represent at least 70 per cent of the national production of agricultural limestone.

H. C. Krause, chairman of the Division's committee on soil conservation programs, added much constructive discussion and reported in interesting detail some of the experience with the Congressional subcommittee. That the producers appearing before the committee of two or three Congressmen preserved their sense of humor, it seems to this reporter, is ample evidence that they could not have resorted to the usual methods of high pressure lobbying, even had they wanted to. Nevertheless, apparently they got little credit for their efforts in behalf of the general welfare.

Directors Present

There were regrettably few members of the board present, perhaps because it was the fourth of July, which is a traditional American family holiday. However, these stalwarts answered the roll call:

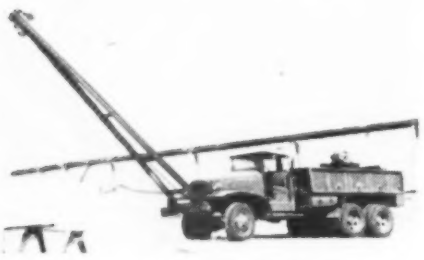
S. P. Moore, chairman; J. Reid Callanan (substituting for H. E. Battin, Jr.); Earle L. Dingle; S. B. Downing, Jr.; A. W. McThenia; O. M. Stull; H. A. Clark; A. K. Hausmann; P. E. Heim; M. E. McLean (substituting for W. E. Hewett); H. C. Krause; F. W. Mumma; W. F. Wise (substituting for E. V. Scott); John J. Stark; representing the National Crushed Stone Association, Otho M. Graves.

HINTS and HELPS

PROFIT-MAKING IDEAS DEVELOPED BY OPERATING MEN

Truck Crane

TRIANGLE ROCK AND GRAVEL CO., San Bernardino, Calif., mounted a utility crane on one of its heavy trucks as shown in the illustration.



Truck equipped with crane boom

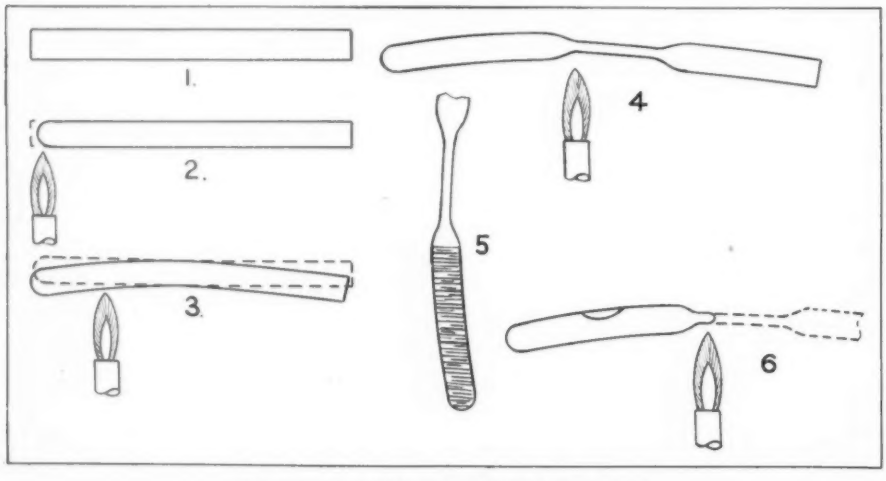
The hand winch is bolted to the body section through suitable channel iron sections. The winch can be easily removed if desired, and the truck used for other uses without too great inconvenience. Likewise the boom can be removed, if desired. Many uses have been found for this utility crane.

Tubes for Broken Levels

By J. F. PRUYN

QUITE frequently a bubble tube is broken in a level and it cannot be easily replaced. In the illustrations are shown the various steps required in making a bubble tube.

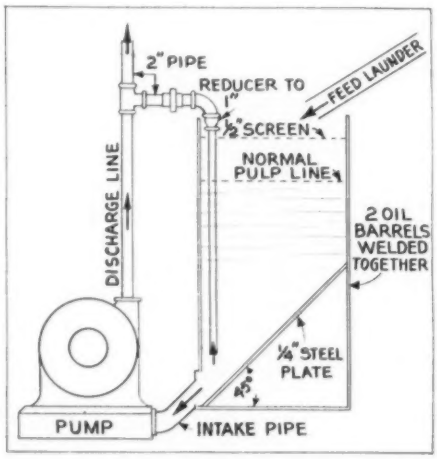
Take a section of glass tubing about 6 in. long, Fig. 1, about ⅜-in. in diameter. Fig. 2, roll end of tube in Bunsen burner flame until end seals itself. Fig. 3, use a broader flame or move the glass tube over a wider section, and heat tube until it bends slightly. Fig. 4, heat tube a couple of inches back from the closed end. When glass is soft, draw end out until it necks down a few inches. Tube will seldom close up entirely. Fig. 5, fill tube with water, kerosene, toluol, alcohol, etc. Then let unfilled section dry thoroughly. Fig. 6, hold tube in a point flame and rotate. If tube has been necked down properly, tube will seal itself off and break away, leaving the finished bubble tube, before water boils. Tubes can be mounted in level with plaster of paris, putty, etc.



Six steps in making a bubble tube for a level

Pumping Coarse Material

A WESTERN OPERATOR was confronted by a problem in pumping minus 10-mesh, plus 40-mesh sand, using a 2-in. Wilfley pump which he finally solved by the following method.



Showing how sanding-up of pump was prevented

Occasionally the unit would sand-up, causing the usual confusion. First, a sloping bottom was put in the feed sump tank which comprised two oil barrels welded together. This helped some but did not solve the trouble so the discharge line was cut and a "T" installed in it with provision for returning a portion of the discharge close to the intake of the Wilfley pump, as shown in the drawing.

As the lift of the pump was about 50 ft., a high velocity flow went through the 1-in. pipe, causing a continuous turbulence in the bottom of the feed tank. This eliminated surges and no sanding troubles developed thereafter. However, the elbow and reducer at "A" cut out after about a month's operation, and as rubber was not then obtainable, a union was provided back of the elbow and a spare assembly was kept at hand. Every four weeks (on Sunday when the plant was down), a new elbow and 1-in. pipe was installed so that smooth and continuous operation resulted.

Extended Air Filters

IN EL PASO, Texas, water for processing commercial crushed stone is practically out of the question so producers, such as the Hugh McMillen Contracting Co., operate dry plants. This company uses two portable crushing plants, a Pioneer and a Cedarapids. In the entire assembly are

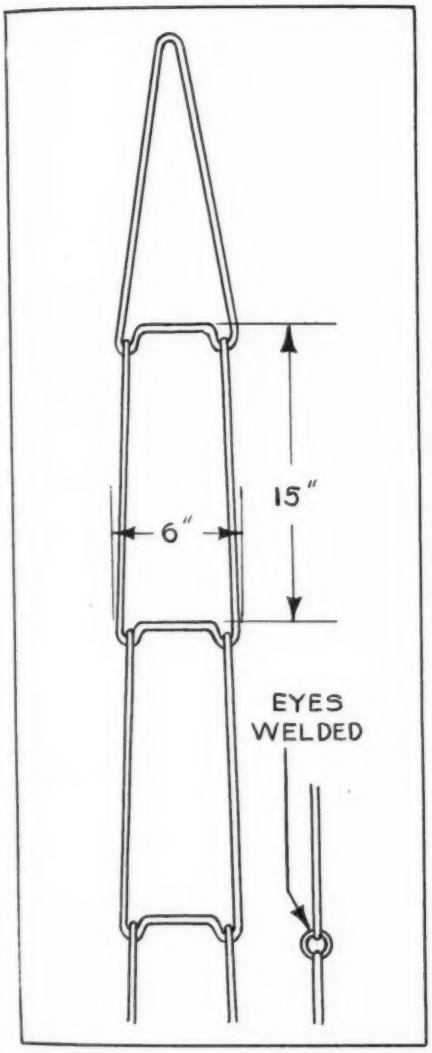
Air filter for Diesel engine connected to long extended intake pipes to keep it out of dusty atmosphere

four D-13 Caterpillar Diesels operating the two portables, compressor and the primary crusher. The Diesels use about 45 gal. of oil per day each.

As dust from plant operation must be kept out of the Diesels, the dust filters, except the compressor, have a long 4-in. diameter steel pipe connected to the engine intake for a distance up to about 200 ft. in one case. At the far end of this pipe is the air filter which is mounted as shown in the illustration. By having the filter at the extended distance from the plant, air with a lower dust content is obtainable.

Flexible Ladder

ILLUSTRATED is a very simple but efficient type of flexible ladder which is easily made from ⅜-in. dia. round



Portable ladder made in blacksmith shop

iron by a blacksmith. It is readily portable and can be used in confined spaces; it will stand hard work and is useful for drillers on a quarry face, or for affording temporary access to kilns, silos, etc.

Cable Hooks

By PAUL C. ZIEMKE

IN the accompanying illustration is shown a double-hook installation installed on all equipment coming into the shop for general overhaul jobs. Cables are neatly coiled for convenient service to any job of welding within reach with sufficient length for the average job.

Each welder, either gas or electric, is equipped with a 2-lb. CO_2 fire extinguisher. Every welder is inspected in the field at 30-day intervals by a skilled mechanic who makes all minor repairs and adjustments on the spot and retires all major repair jobs to the shop.

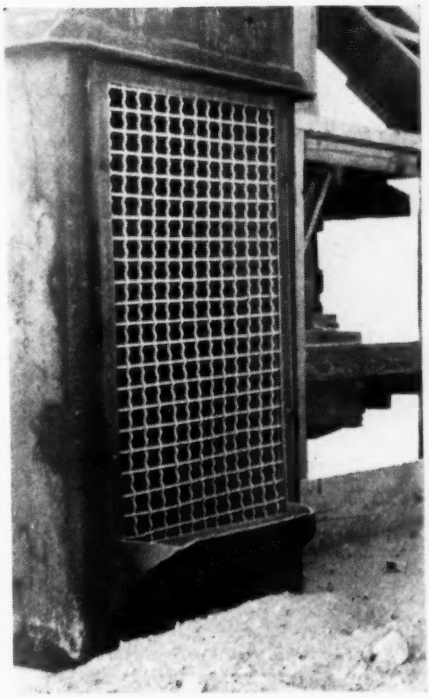
Pump Drive

AT a sand and gravel plant in New Mexico all the plant operations are operated by internal combustion engines, mostly butane gas with some Diesels and gasoline units. For a part of the plant's water supply, a well has been located very close to the plant—no long pipe line being needed.

This well used a Peerless deep well pump driven by a Caterpillar D4400 through a right-angle drive connected directly to the engine's power take-

Deep well pump located next to the plant is driven by butane gas operated engine supplied fuel from a tank located some distance from the plant

off shaft. The assembly is very neat and serviceable. This power unit is driven by butane gas fed from a centrally located supply tank serving several of the other engines used in the operation. By having one supply source for several engines, servicing of the fuel is kept at a minimum. The main tanks are located far enough away from the main plant to present no fire hazard.



Screen provided for inspection of elevator boot

Inspection Screen

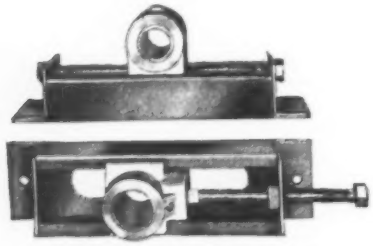
FOURTH STREET ROCK CO., San Bernardino, Calif., recently built a new sand and gravel plant under the direction of Southwestern Engineering Co. Crushed gravel from the Pacific primary crusher is scalped out on a 2- x 5-ft. Link-Belt vibrating screen with the oversize falling to a Symons cone crusher. The crusher discharges to a bucket elevator encased in a steel housing. Near the cone crusher, the elevator housing has been provided with a piece of wire cloth, shown in the illustration, so that the operator can see what is going on inside. A lower lip below the screen is provided to permit spillage to be returned to the elevator.

Welder equipped with cable hook to facilitate handling

new MACHINERY

Belt Conveyor Take-Up

PATRON TRANSMISSION CO., New York, N. Y., has designed a compact take-up for a belt conveyor which is built with a pressed steel frame. It



Belt take-up with 6-in. travel

has corrosion-acid-resistant bearing housing fabricated from a specially heat treated aluminum alloy to give strength and light weight. The bearing is equipped with a porous bronze ledaloyl bushing which is said to be self-lubricating. Sizes range from 15/16 in. up to 1-5/16 in. in two types classified "A" and "B."

Primary Crushers and Grinding Machinery

NORDBERG MANUFACTURING CO., Process Machinery Division, Milwaukee, Wis., has announced that it is now in production of a broad line of heavy primary crushing and grinding machinery for the reduction of rock, ores and non-metallic minerals for basic industries.

Primary jaw crushers are available in the larger sizes from 30- x 42-in. up to 72- x 96-in.; primary gyratory crushers in sizes from 30-in. up to 72-in.; and grinding mills from 6 ft. to 10 ft. 8 in. in diameter and up to 50 ft. long. Rotary dryers, calciners, kilns, and coolers are included in the products manufactured by this division of the company. This equipment supplements the line of Symons cone crushers.

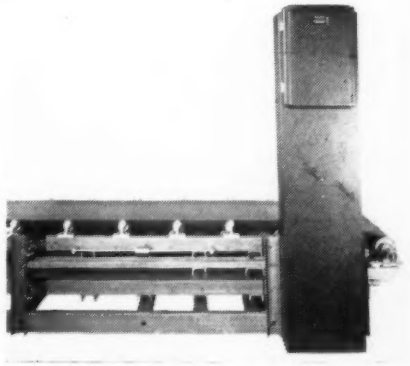
Cutting Torch

AIR REDUCTION SALES CO., New York, N. Y., announces that its Airco Series 9000 cutting torch with monel metal head and stainless steel tubes, discontinued during the war years because of a shortage of critical materials, is back on the market. The standard torch is 21 in. long and weighs 3 lbs., 4 oz. It is usually supplied with a 75 deg. or a 90 deg. head but straight heads are also available.

Continuous Weighing

BUILDERS-PROVIDENCE, INC., Providence, R. I., has developed the Conveyoflo Meter for continuous weighing of dry materials on conveyor belts. This meter utilizes diaphragms instead of the knife-edge-beam principle for metering flow of dry materials by weight.

The scales may be used to proportion and control, as well as weigh, the feed of one or more dry materials such as cement, and sand and gravel. The weighing section is supported at one end of self-aligning ball bearing pillow blocks, and at the other end "floats" on a diaphragm which transmits load changes hydraulically to the weighing mechanism. A cyclometer type totalizer reads directly in any unit desired, it is non-cyclical in operation, employing the disc-and-

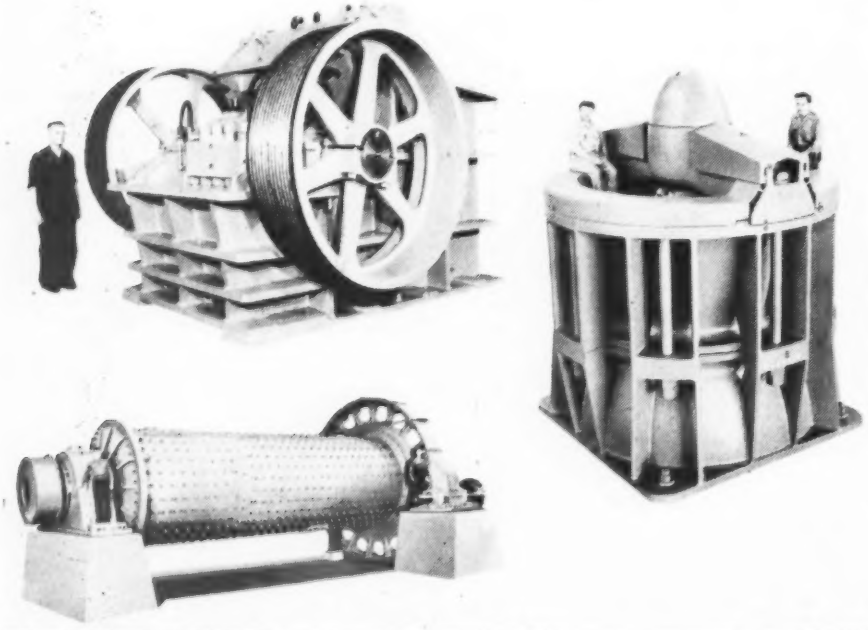


Automatic, continuous belt conveyor weighing mechanism

wheel integrating principle, and is claimed to be automatically corrected for any belt speed variations. Integration is automatically compensated for variations in belt weight and for adherence of material to the belt, through a system of return belt weighing.

Repairing Tread Cuts

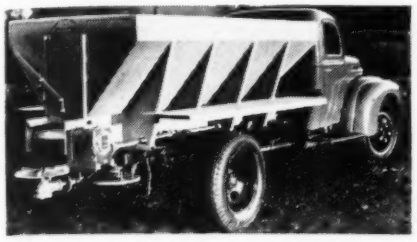
THE GOODYEAR TIRE & RUBBER CO., Akron, Ohio, has announced a new method of treating shallow tread cuts which do not penetrate into the fabric plies. B. C. Eberhard, manager of tube and accessory development, points out that these cuts are not particularly detrimental to the life of a tire, but the real danger results from stones, gravel, or other foreign objects becoming wedged in the cut and continuing to work into or through the tire. The new method simply involves probing the cut to remove all foreign material, then by the use of a sharp pointed knife or rasp, trimming out or grinding around the cut to form a cone-shaped cavity to extend to the bottom of the cut. After the cuts have been trimmed out, the tires can be continued in service.



Upper left: 36- x 48-in. primary jaw crusher, available in sizes up to 72- x 96-in. Upper right: 30-in. gyratory crusher, available in sizes up to 72-in. Lower left: 9½- x 32-ft. grinding mill, made in sizes from 6 ft. to 10 ft. 8 in. diameter and up to 50 ft. long

Combination Dump Body And Lime Spreader

WESTON DUMP BODY CO., Des Moines, Iowa, recently placed on the market a combination lime spreader



Special body designed for spreading limestone or hauling gravel and rock

and dump body suitable for rock and gravel haulage.

When used for agricultural limestone spreading, a 20-in. wide drag-chain conveyor carries the "lime" onto a 21-in. distributor fan. As the truck is driven over the field, the fan spreads the lime evenly over a strip of land 30 ft. wide or more, depending upon the speed of the truck.

The heart of the operating mechanism of this combination body is a cone-drive speed reducer, designed and produced by Cone-Drive Division, Michigan Tool Co. It is used to transmit power from the power take-off shaft to the drag-chain conveyor, and is of the pinion-under type with a 30:1 reduction. This type of gearing was chosen for its great load carrying capacity.

Combination bodies are made to order, being available in 9-ft., 11-ft., and 13-ft. lengths with the gear box ratio set for best service on each truck chassis. Dump gates in the bottom of the body open to a width of 5½-in. to allow rock and gravel to drop freely when using the truck for gravel hauling. Two levers operate these gates, the left-hand lever tripping the center gates to drop the load and the right-hand lever closing and locking the dump gates.

Multi-Purpose Shovel

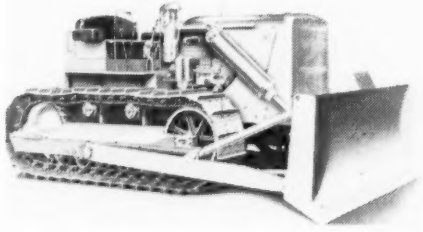
MARION POWER SHOVEL CO., Marion, Ohio, has announced a ¾-cu. yd. machine, the 33-M, which, with various front-end combinations, may serve as a shovel, dragline, clamshell, crane and backhoe.

Some outstanding features of this machine include: air control, a greatly simplified machinery deck with only two shafts across the deck, simple change-overs for front-end equipment, and the use of 22 ball and roller bearings. Only 12 gears are used in the entire machine.

Conversion of the front-end does not require any changes of drum lagging, sprockets, levers, etc.; the same drums are used on all combinations. The shovel boom also serves as the boom for the backhoe. The crane boom point is adaptable without change for crane, clamshell, dragline and pile driver service. Air control covers all digging motions, gear changes and the operation of the steering clutches, propel brake, swing brake, dipper trip and engine clutch. A maximum of 12 lb. pressure operates any air control lever.

Hydraulic Controlled Bulldozer

CATERPILLAR TRACTOR CO., Peoria, Ill., is now in production on four sizes of hydraulically controlled bulldozers. Designed for use with Caterpillar Diesel D8, D7, D6, and D4 track-type tractors, these bulldozers are matched in capacity to the power of the tractors for which they are designated. Cable-controlled bulldozers for D8, D7, and D6 models are also available.

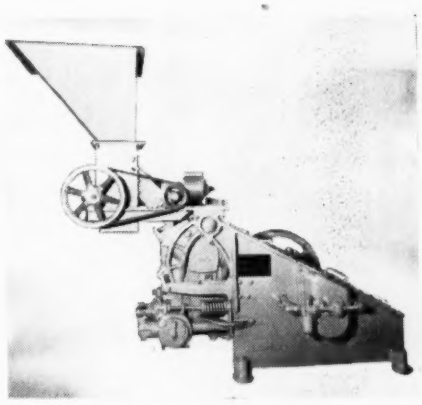


Tractor equipped with hydraulically-operated bulldozer

Features of the hydraulic system include: front mounted, positive action, balanced vane pump, integral with tank and operating valves. The manually operated three-position valve has "raise," "lower," and "hold" positions.

Crusher with Self-Contained Feeder

STRAUB MANUFACTURING CO., Oakland, Calif., has designed its No. 20 Kue-Ken crusher with a gearmotor



All-steel crusher, with dust-tight, sealed lubrication

driven feeder, making a self-contained unit. The feeder is said to be easily adjustable to suit requirements. It is pointed out by the manufacturer that this special unit is particularly suitable where a controlled feed is desired to make the minimum amount of fines. Capacity of this crusher on medium hard, dry material is 8 to 10 tons per hour at ⅝-in. jaw setting.

Smoke Indicator

PHOTOSWITCH, INC., Cambridge, Mass., has developed a smoke indicator, Type A20C, which indicates the density of smoke passing through the flue or breaching of a heating or power plant, and signals when this density approaches the values prescribed by municipal smoke ordinances. It consists of a photoelectric control and light source. These are mounted on opposite sides of the flue, and the light source beam is projected across the flue onto the photoelectric control. A sensitivity adjustment permits the equipment to be set so that it will signal when smoke density approaches whatever value is prescribed as maximum by the local municipal smoke ordinance.

Shovel of ¾-cu. yd. capacity adaptable to dragline, clamshell, crane and backhoe service

Recovering ASBESTOS Floats with Dust Collectors

By L. J. WIESCHHAUS*

DUST clouds created in the milling of asbestos have long defied efficient and economical collection and it is only recently that this problem has been successfully solved. Because of the vast quantities of asbestos lost in the form of dust and because of the high market value of these "floats" at the present time, it may be well to consider some of the factors involved in the collection of asbestos.

The physical properties of asbestos, while not unique individually, present a combination of problems which are a tax on the ingenuity of the dust collector engineer. A few of these properties are:

1. **Fibrous nature.** The characteristic of a fibre is that it has a tendency to interlace and form a mat which makes pneumatic handling difficult.

2. **Friability.** Asbestos has the ability of breaking down successively into smaller and smaller fibres, thus ultimately creating a dust of such minute particle size that it becomes suspect of being hazardous. This means that a successful collector must have an extremely high degree of efficiency for particles of a size smaller than 10 microns.

3. **Effect of Moisture.** As the particle size decreases it becomes increasingly affected by moisture which, when present in excessive amounts, causes the dust to "cake" in a solid, impermeable layer on any filter medium.

4. **Low apparent specific gravity.** Although its real specific gravity is 2.54 to 2.59, finely divided asbestos has an apparent specific gravity of only about 1/4 or 1/5 of that figure. The fibrous, fluffy nature of the material is a serious handicap in any settling operations.

These are the principal physical characteristics which are important for considering the problem of dust recovery in this industry.

Types of Collectors

In the milling of asbestos the principal sources of dust are in the crushing, sizing and grading operations. All of these are controlled by preliminary cyclone type collectors and the success with which the dust is removed from the source depends primarily upon the design of the hood arrangement. Unfortunately, the low velocity cyclone type collectors generally used are often inefficient with respect to settling out the finer sized particles, and it is in the collection of dust from the discharge of these cyclones that the real problem of dust control arises in the asbestos industry.

One secondary form of collector which has been used in practically all asbestos mills is the dust shed. The dust shed serves two main purposes: (1) it serves as a settling chamber so that a large portion of the effluent from the cyclones can settle out by gravity before it is discharged into the open air and (2) by removing the discharge point to a remote point from the mill proper, it seeks to assure that most of the dust will be carried away by the wind rather than being returned to the working area. One obvious disadvantage of this method is that it permits vast quantities of dust of low particle size to float over the surrounding area.

Another method of dust prevention which has been tried is "wet" processing. This method does serve to eliminate a great deal of the dust normally attendant on asbestos preparation, however, it resulted in almost insurmountable production difficulties. The time required and the handling problems encountered in drying the material at the proper temperature made the process impractical. Also, a certain amount of handling was required after the material had been dried and it was still necessary to provide some sort of dust collection methods for the dust created in this operation.

Another type of collector which has been used in this industry and which has met with considerable success is the electrostatic type of collector. Electrostatic collectors, however, have two serious drawbacks: First, the cost of the original installation varies with the degree of efficiency desired, and the relationship between cost and efficiency is that of an acutely rising curve, rather than a straight line. Second, for maximum efficiency, an electrostatic collector must be designed for operation at a fairly definite dust concentration and its efficiency drops off when it is used at any other concentration. In adapting a collector of this type to the asbestos industries it must be designed for median operation and hence cannot be expected to operate at its maximum efficiency at all times. The reason for this is the great variation in dust load which results from variations in rock, rock temperature, mill temperature, moisture conditions, etc.

Even under the most ideal conditions, and especially so under the operating conditions which prevail in the asbestos industry, there is a certain amount of effluent from electrostatic collectors. Even though the collector may be 98 or 99 per cent overall efficient, the effluent is visible, which

*Market Research Engineer, American Wheelabrator & Equipment Corp.

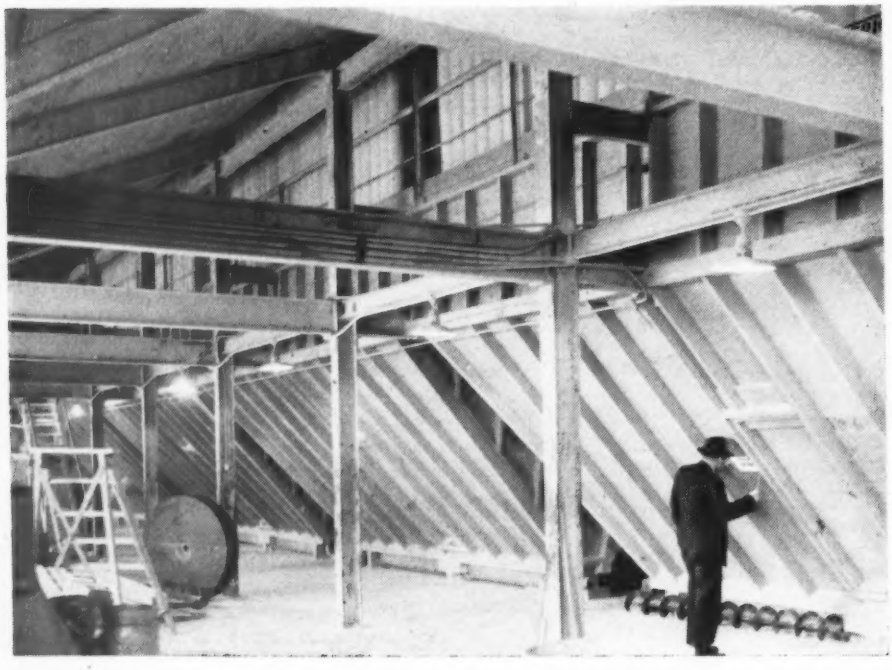


Fig. 1: Partial view of the collector installed at the Johnson's Co. mill in Thetford Mines, Quebec. Four of the six collectors are visible. Inspection window may be seen to the right

is a sociological disadvantage, and it is of very small particle size. This type of collector does have two distinct advantages over most other collectors in that it has very low power requirements and very low back pressure.

Another type of collector which has been tried in the asbestos industry, and which has met with considerable success, is the filter type. Filter type collectors, when using ordinary cloths, are at a disadvantage in certain operations where extremely high temperatures or high moisture contents are encountered or in collecting material of a viscous nature, however, when properly applied, they are ideally suited for a material such as asbestos floats.

From a consideration of the physical characteristics of asbestos, as described above, it will be seen that considerable care must be exercised in designing any type of filter to handle this material.

Because of the fibrous nature of the particles, the filter material must be of such a material and weave as to offer the least possible encouragement to the fibres to interlace and interlock with the fabric. This is very important if the shaking mechanism is to do an efficient job of cleaning the bags.

Because of the friability of asbestos with its resultant small particle size, it is important that the cleaning cycle and cleaning mechanism be designed so that they leave a certain amount of "filter cake" on the bags at all times. The "filter cake" is the actual filtering medium and is absolutely necessary if the fine particles are to be stopped. This, incidentally, prohibits the use of reverse air flow during the cleaning cycle since this practice gets the filter cloth *too* clean.

Care must be exercised to keep the asbestos reasonably dry to prevent caking in the collector.

Bag proportions must be given careful consideration because of the very low *apparent* specific gravity of asbestos. If the bag length is too great in proportion to the diameter, the bag will form a trapping structure when it is shaken, greatly hampering the cleaning operation. A useful rule of thumb developed during the years that metallurgic bag houses have been in operation is that the length of a bag shall not be greater than 30 times the diameter.

Filter Type Operates Successfully

An example of the successful use of a filter type collector in the asbestos industry is presented by Johnson's Co., Ltd., Thetford Mines, Quebec, which has had such an installation in operation now for more than six months.

The first step in this installation was the purchase by Johnson's Co. of a small 5000 c.f.m. collector to be used

(Continued on page 176)

Fig. 2: Electrical control panel. Individual manometers are supplied for each collector unit to provide check on completeness with which collectors are shut off during shaking operation. To the extreme right is electrical timer controlling shaking cycle

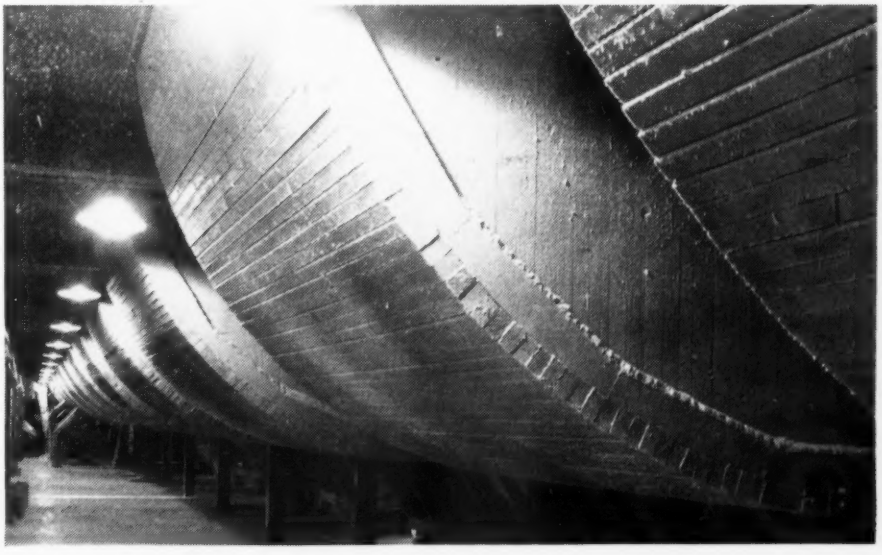


Fig. 3: Inlet duct which carries dust laden air into collector hoppers

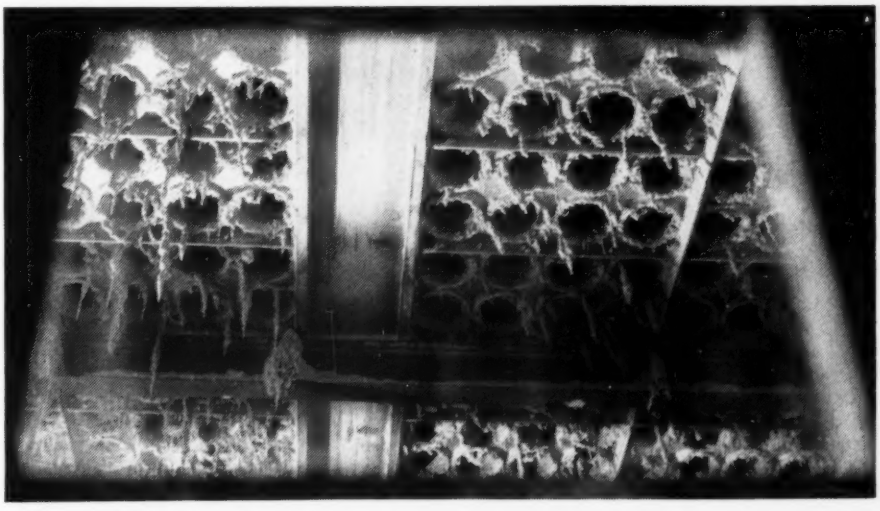


Fig. 4: Underside of cell plate. Note that none of the tubes are bridged over in spite of the "clinging" nature of the asbestos fibers

General view of quarry crushing plant. Minus 6-in. material being discharged to quarry stockpile. Conveyor to truck hopper from reclaiming tunnel, with waste truck hopper in center background. Truck, to the right, is pulling away from hopper for 12-mile haul to damsite plant

Processing Aggregates for Big Dam

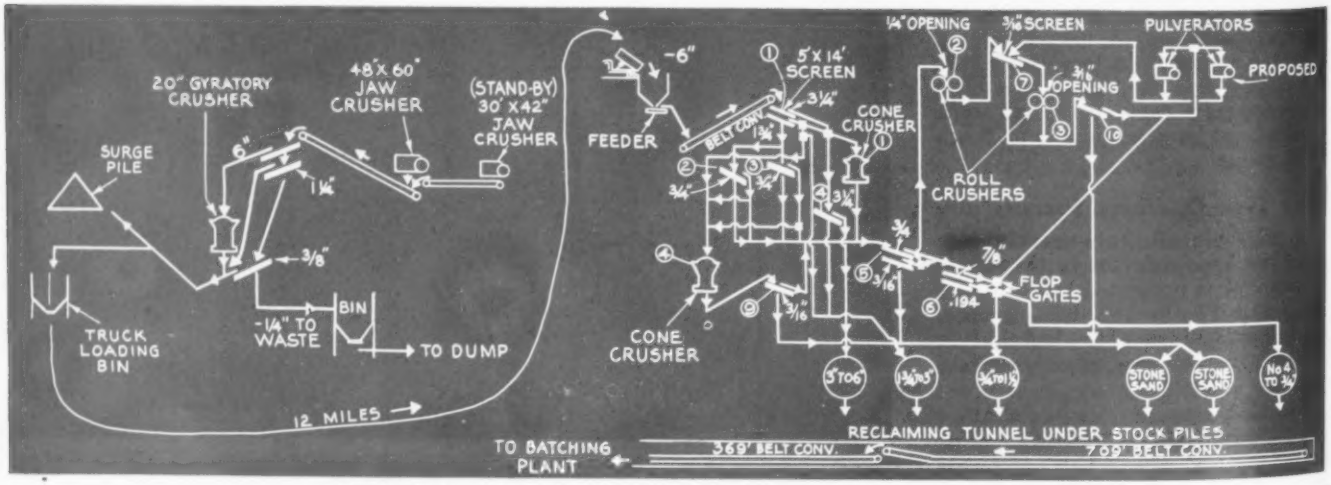
Cumberland Quarries, Inc., operates two plants to prepare aggregates for Wolf Creek Dam in Kentucky. Use dry process to manufacture stone sand

By DAVID MOCINE

AFTER a four-year suspension of activity imposed by the government on all non-critical construction during the war, work has been resumed on the Wolf Creek Dam across the Cumberland River in Russell County, southeastern Kentucky. This dam and reservoir, the largest of six projected by the United States Engineer Corps in the Cumberland river basin for flood control, generation of hydroelectric power and recreation, will consist of a rolled earth embankment across the flood plain portion of the valley and concrete sections to connect the earth embankment with the high bluff on the south side of the river. It will contain about 1,250,000 cu. yd. of concrete and 9,000,000 cu. yd. of rolled earth fill. Total length of the dam will be 5730 ft., of which 1836 ft. will be concrete. The cement contract calls for 1,400,000 bbl. of both natural and modified portland.

Located approximately 10 miles southwest of Jamestown and 12 miles north of Albany, Ky., the damsite is 461 miles above the confluence of the Cumberland and Ohio rivers. Of the six dams planned before the war, one is complete (except for the power plant installation); two, including Wolf Creek, are under construction; and the remaining three in this tributary water shed to the Ohio river are still in the blueprint stage.

All aggregate for construction of the dam is being supplied by Cumberland Quarries, Inc., a corporation formed by Norman Kelb in 1941 when the dam was first planned. This new venture marks Mr. Kelb's re-entry into the crushed stone business, which he left in 1940 upon selling his interests in the Ohio and Indiana Stone Co. and the Erie Stone Co. He was



Flowsheet of crushing and screening operations at quarry and damsite plants

Left: Upper quarry level showing stripping shovel and well drills. Right: Loading stone from upper quarry level with 2½-cu. yd. shovel into large capacity haulage units

reelected to the board of directors of the National Crushed Stone Association last year, a position which he held for many years prior to 1940.

In the summer of 1942 when work on the dam was halted, not only most of Cumberland's quarrying, crushing and screening equipment was already installed, but also the major share of the general contractor's batching, mixing and placing equipment. Cumberland Quarries, under contract first to the contractor and later to the government, assumed responsibility for maintenance of all properties during the four years that intervened between installation and resumption of operations.

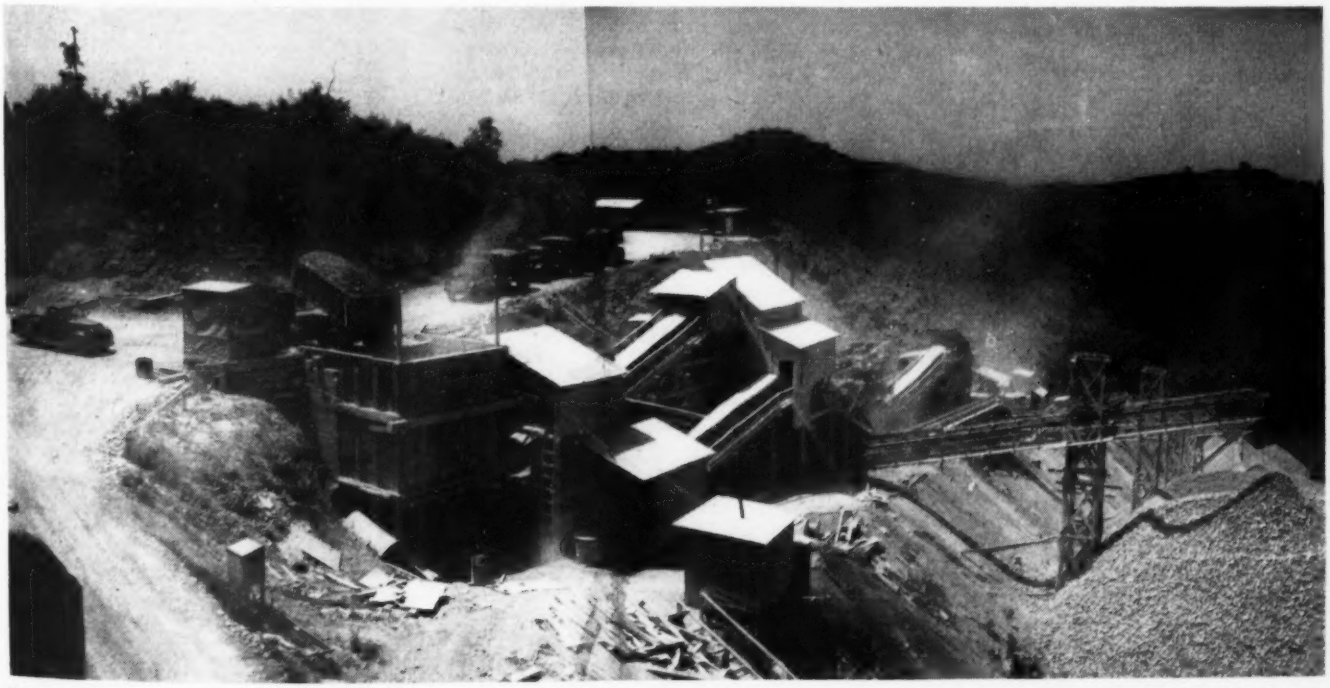
Construction and operation of the crushing plant is similar in many respects to other large crushing installations for recent dam and reclamations projects, but is of particular interest because of its dry-process manufacture of stone sand to meet rigid specifications of the U. S. Engineer Corps. Of the manufactured sand, 12 to 13 per cent passes 100-mesh. The other four crushed stone sizes are: 3- to 6-in.; 1¾- to 3-in.; ¾- to 1½-in.; and No. 4 mesh to ¾-in.

Mixing schedules at the dam call for from 25 to 27 per cent of total aggregate as sand, which falls within the following specifications:

Per cent passing	Screen size
4 to 15	100-mesh
15 to 30	50-mesh
45 to 80	16-mesh
98 to 100	4-mesh
100	⅜-in.

In continuous tests run at the damsite by the U. S. Engineers on this manufactured sand (under the supervision of L. Campbell, Jr., engineer of materials), it is found to be uniform in gradation and of excellent particle shape. Specifications state that the sand grains must be 80 per cent or more cubical (the longest dimension must not be more than three times the length of shortest dimension) with a minimum of round or flat particles.

According to A. B. Johnson, general superintendent for the entire quarrying, crushing and screening operation, this unusually high grade stone sand results principally from the use of a secondary 5- x 14-ft. single deck Allis-Chalmers vibrating screen in-



To the left may be seen semi-trailer dumping minus 6-in. stone from quarry to hopper at final screening and crushing plant. Primary double-deck screen and crusher are housed next to truck hopper. To the right are the finished stockpiles

One of 18 manually-operated gates in tunnel under six stockpiles at damsite

Conveyor inclining up from main quarry stockpile reclaiming tunnel

Louis Campbell, Jr., materials engineer, U. S. Engineer Corps, left, and Clarence Lowe, screening plant superintendent

stalled in the primary crushing plant flow at the quarry proper. This screen receives throughs from the lower (1½-in.) deck of the primary screen. The mesh sizes are varied, depending on the weather, from ¾-in. in wet weather to ⅝-in. in dry. This secondary screen removes fines that come from thin laminated partings between various limestone beds, dirt that is lodged in crevices in the upper quarry and bits of the argillaceous material that may have found its way into the flow from an 8-ft. strata that separates the two working faces of the upper and lower quarry.

By removal of objectionable material at this point, two scrubbers that were originally installed have been by-passed and the material is processed dry. Throughs from the secondary screen are elevated by a 24-in. conveyor on 80 ft. centers to a truck hopper. From the hopper the material is hauled 100 yd. to a large dump area. Some of this material is used by Cumberland for maintenance of the 12 miles of road separating the quarry and damsite, and a little is sold locally either to individuals or counties for road maintenance. At the present time this partially processed stone is waste, but there is a possibility that in the future it may be reworked and used.

When the crushing operation was originally planned, a deposit of limestone much closer to the damsite was under consideration, but when the needs of the dam became apparent, the site chosen was abandoned as too small. The present quarry location, 12 miles from the dam, not only is adequate in content, but also contains a better grade (high calcium) limestone of the St. Genevieve type. Primary crushing and screening (sizing material to minus 6-in.) is carried out at the quarry in a plant of 500 t.p.h. capacity, from which point the material is trucked 12 miles to the final crushing and screening plant at the damsite.

Quarry Operations

Quarrying operations are carried out on two levels, with the upper quarry strata being worked on a 30- to 45-ft. face and the lower quarry on a 90-ft. face. This double operation is made necessary by the fact that the two beds of limestone are separated by an 8-ft. strata of argillaceous limestone that is unsuited for concrete aggregate. This strata is stripped with a 2½-cu. yd. shovel and trucked to waste in the same manner as the 10- to 15-ft. overburden. The exposed level, or upper quarry, is composed of limestone similar to that found in the lower quarry, but containing more dirt and foreign matter in crevices and cracks. After blasting, the stone is loaded by shovel and trucked 2000 ft. down the hill to a primary crushing and screening plant. It is a level haul of about 1000 ft. from the floor of the lower quarry to the crusher. The limestone of both quarries analyzes about 95.5 per cent $CaCO_3$.

The quarry uses three crawler-mounted shovels, including two 2½-cu. yd. 54-B Bucyrus-Erie models and a 2½-cu. yd. Marion. All shovels are Diesel powered, and are used according to need—for stripping or in the first or second quarry. Seven quarry haulage units are operated according to requirements. These units consist of four Euclids (9- and 11-cu. yd.) and three Koehring Dumpters (6-cu. yd.) capacity. Two 375-hp. Buckeye Diesels turn two 275-k.w. General Electric generators, providing all the electric power requirements of the quarry and primary crushing unit. The Diesels may be run individually or simultaneously, depending on the needs of the plant. Fuel consumption of these Diesel units is figured at 8 gal. per hr. per engine.

Electric blasting caps, wired to shoot simultaneously, are used exclusively. Rock is brought down in the ratio of 2½ tons per lb. of explosive used. Two charges are used in primary blasting: 6- x 22-in. and 6- x 16-in. of 60 per cent gelatine dynamite. For secondary blasting the charge is 1¼- x 8-in., with 40 per cent gelatine. Four Keystone gasoline powered well drills (6-in. hole) and three Cleveland wagon drills (2½-in. hole) are used for primary drilling and two of the ten Cleveland H-10 jackhammers at the quarry are in constant use for secondary drilling.

Haul Stone by Truck from Quarry To Plant at Damsite

Haulage units from the quarry dump into a hopper that discharges over a Traylor pan type feeder to a 4- x 5-ft. Allis-Chalmers jaw crusher, set for a 7-in. opening (300 t.p.h. capacity). A 36- x 42-in. Traylor jaw crusher (100 to 150 t.p.h. capacity) is being set up next to the original crusher to serve as an auxiliary, and will discharge to the same belt as the first. This second crusher will be fed by a vibrating feeder directly from a truck loaded hopper.

Material from the primary crusher is conveyed by a 36-in. belt, 130 ft. centers, to a 5- x 12-ft. Allis-Chalmers

Sample of stone sand showing the excellent particle shape

To the left: Quarry hopper and primary crusher, left; auxiliary crusher being installed to the right. To the right: Cone crusher at final screening plant

Ripl-Flo double-deck screen, with the top deck having 6-in. square openings, and the bottom deck having 1¼-in. round openings. Oversize from the top deck (plus 6-in.) is chuted to a No. 10 Allis-Chalmers 20-in. gyratory crusher with a 3-in. discharge. Oversize on the second deck goes directly to the main stockpile, along with the product of the secondary crusher. Throughs from the second deck (minus 1¼-in.) are chuted to a single-deck screen with ⅜-in. mesh, previously mentioned, oversize going to the main quarry stockpile and throughs are conveyed to a truck bin from which it is hauled to a waste dump.

A 30-in. conveyor on 250 ft. centers carries the throughs from the top deck of the primary screen, oversize from the secondary screen and the output from the secondary crusher, to one main stockpile. This material is reclaimed by a tunnel under the surge pile with two manual gates and one Link-Belt apron feeder that discharge to a 30-in., 200 ft. centers, belt conveyor, elevating the material 60 ft. into a two-bin truck hopper. This minus 6-in. material is trucked 12 miles to the secondary crushing and screening plant at the damsite in 22 semi-trailer trucks: 11 belonging to Cumberland Quarries and 11 operated by R. R. Webb, subcontractor of Shelbyville, Ky. Cumberland's fleet consists of White tractors with 12-yd. McCabe-Powers trailers. Three more units are on order by Cumberland, bringing the total number of units for hauling the stone from quarry to damsite to 25.

The haul to the damsite is over rolling terrain typical of the Kentucky hill country, with no grades of more than a few per cent encountered except at the entrance to the damsite, where perhaps 300 ft. equal 10 per cent grade. Secondary screening and crushing is completed in a plant stepped down one side of a small valley in back of the dam proper. Finished material is conveyed out over the valley and drops to surge piles that feed a reclaiming tunnel conveyor.

Final Crushing and Screening

Material from the quarry (minus 6-in.) is dumped into an 8-ft. deep 10- x 12-ft. hopper fitted with a Link-Belt apron feeder that discharges to a 30-in. belt which conveys the material to a 5- x 14-ft. double-deck Allis-Chalmers Ripl-Flo screen (No. 1, see flowsheet) with 3¼-in. top deck and 1¾-in. bottom deck. The finished product in this plant must be varied as to size, depending on the requirements of the batching plant, so the flow from the primary screen and other screens enters several flop gates for possible diversion to different streams of flow. Oversize from the first deck of screen No. 1 can either go to a second 4- x 10-ft. Ripl-Flo screen with 3¼-in. mesh (with oversize from this screen, No. 4, being conveyed directly to one of the six storage piles), or from the flop gate this same oversize can be diverted by a short conveyor (24-in.) to a 4¼-ft. Symons cone crusher (No. 1) with a capacity of 100 t.p.h. (reduction from minus 6-in.), driven by a 125-hp. motor and with variable opening averaging ¾-in. Throughs from the first deck and oversize on the second go to a flop gate for possible diversion to crusher No. 1 or No. 4 (4-ft. Symons short head cone, 100 t.p.h. capacity with ½-in. opening, powered by a 150-hp. motor). The third possible route for this material (minus 3¼-in. plus 1¾-in.) is directly to a second stockpile.

Herman Nagel, quarry superintendent, standing in doorway of power plant building. Twin Diesels may be seen to the right and left

Six stockpiles, when full, will each contain about 9000 tons. The six conveyors carrying finished materials to the stockpiles vary in size from 24-in. for the 3- to 6-in. material to an 18-in. belt for the three piles ranging from No. 4 up to 3-in. Two 20-in. belts convey sand to two stone sand stockpiles. All six of these conveyors are on 125 ft. centers and discharge at a point 75 ft. above the valley floor.

Throughs from the bottom deck of screen No. 1 go to two 4- x 10-ft. Allis-Chalmers Aero-Vibe single-deck screens (No. 4 and 4) with ½-in. mesh, running in parallel. Oversize from these two screens may either go to crusher No. 4 or screen No. 5 (5- x 14-ft. Ripl-Flo double-deck screen with ½-in. mesh on top and 3/16-in. mesh on the bottom) on the same 24-in. conveyor receiving discharge from crusher No. 1. Crusher No. 4 discharges to a 24-in. conveyor and thence to a 4- x 10-ft. Aero-Vibe

Left: Long reclaiming conveyor tunnel emerging under cable tower track to batching plant. Center: Overall view of damsite, looking north from batching plant, with concrete bucket being lowered over penstock placement. Right: One of two cable-way buckets being lowered to receive concrete from flat car hopper

single-deck with 3/16-in. mesh. Oversize from this screen goes to screen No. 5 via the previously mentioned 24-in. conveyor. Throughs from screen No. 9 go directly to sand stockpiles. Two 48- x 24-in. Telsmith sand drags have been by-passed for the same reason that scrubbers were by-passed in the quarry crushing plant, but are still in the plant for possible emergency use.

Oversize from screen No. 9 is conveyed to screen No. 5 on the same 24-in. conveyor that gathers a possible four other flows. Screen No. 5 is a double-deck 5- x 14-ft. Ripl-Flo (top deck ½-in. and lower deck 3/16-in.). Oversize from the first deck travels via a 24-in. conveyor to screen No. 6 (5- x 14-ft.) Ripl-Flo double-deck screen with ¾-in. mesh on the top deck and 0.194-in. openings on the lower deck. Oversize from the first deck goes directly to stockpile, oversize from the second deck goes to a second stockpile and throughs from the second deck to go stockpiles as sand.

Oversize from the lower deck of No. 5 screen (minus ½-in. plus 3/16-in.) can be chuted to a 24- x 54-in. Traylor AA roll crusher (No. 2) with 75 t.p.h. capacity at ½-in. opening via a flop gate. Crusher No. 2 discharges to an 18-in. belt for conveyance to a 5- x 10-ft. single-deck Aero-Vibe screen (No. 7), with 3/16-in. mesh. Oversize goes to a second Traylor roll crusher set for 3/16-in. opening (both roll crushers are powered by 100-hp. motors). Throughs from screen No. 7 and discharge from crusher No. 3 go to an 18-in. belt discharging to a 5- x 14-ft. single-deck Aero-Vibe screen with 3/16-in. mesh. Throughs from this last screen are conveyed to sand stockpiles.

Oversize from screen No. 10, plus 3/16-in., is chuted to an Allis-Chalmers Pulverator (hammermill) with 25 t.p.h. capacity and powered by a 100-hp. motor. The closed circuit flow at this particular point is of interest because of the hammermill following the two roll mills in the flow to reduce the number of slivery and elongated pieces in the manufactured sand. Discharge from the hammermill is through ¾-in. grate bars and is returned to screen No. 7 (3/16-in.). A second crusher, an XXXO Gruendler pulverator, powered by a 100-hp. motor, is now on order and for additional feed these two hammermills will be able to take the oversize material (through flop gates) from both decks of screen No. 6.

Concrete Batching Plant

The crushed stone at this operation is the property and concern of the crushing company until it drops off the delivery end of the tunnel conveyor to any one of six Johnson Auto-Weigh batchers. Bulk cement is trucked to the site in closed trucks which are unloaded by a Robinson Air Activator to either batching bins or reserve silos (cement is transferred from the silos by a system of bucket and screw conveyors). Air entraining cement is used in the ratio of 25 per cent natural to 75 per cent modified portland by absolute volume.

During the years when operations were suspended on this project the Cumberland Quarries' 11 tractors hauled gasoline trailers in Illinois and Indiana and the trailers were stored on quarry property, as were the well drills. Mr. Webb's 11 semi-trailer units were hauling aggregate in Tennessee to the Oak Ridge atom bomb plant. The three shovels were used to strip coal in West Virginia, as were the Caterpillars, Koehring Dumpters and Euclids. All crushing and screening equipment, as well as the trailers, were given protective coatings of paint and grease.

Ytong—A Swedish Lightweight Building Unit

By F. O. ANDEREGG

WHEN the Gota Canal was built in Sweden in 1932, a mortar made from a mixture of burnt shale and burnt lime was used for setting the stones in the locks. This has proven to be a very rugged material, remaining in first class shape until this day. This mortar, a type of Roman cement, has also given excellent service as stucco on houses.

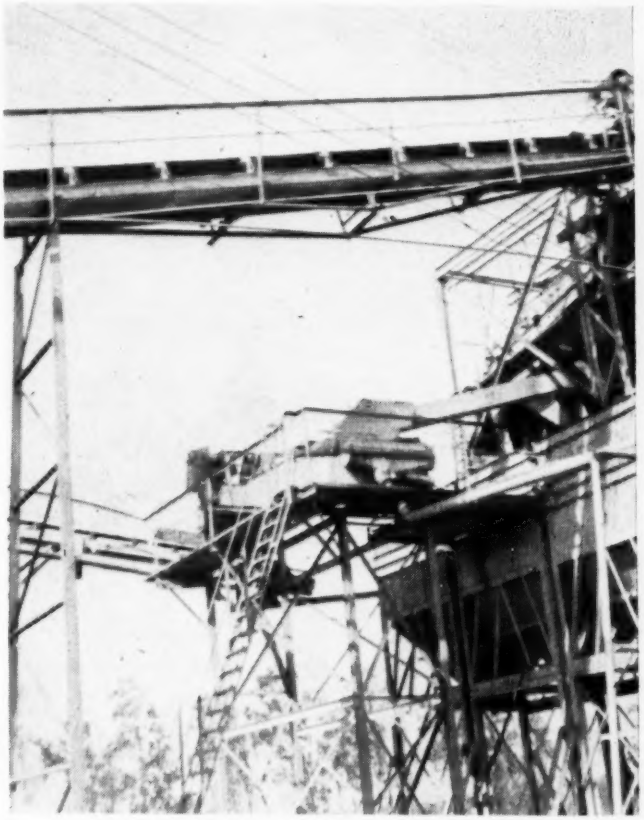
Starting with a finely ground mixture of burnt lime and burnt shale, a cellular concrete is now being made with the aid of aluminum powder, and then is cured in an autoclave in Sweden. At a unit weight of about 44 p.c.f., it develops at least 800 p.s.i., and so is regarded as having satisfactory strength for Swedish buildings when used in 10 inch thickness. At a density of 28 p.c.f., the compressive strength averages 300 p.s.i. The respective "K" values are given as 1.06 and 0.68 B.t.u./in./sq. ft./deg. F. The cost per cubic foot runs about 50¢. The larger size of unit that may be handled should reduce laying costs. Reinforced slabs are being produced for roofing, lintels, etc. The method of curing results in less shrinkage.

The industry in Sweden consists of five plants, the last of which, recently completed, provided more capacity than the four previously built plants. Where a deposit of oil shale is close to a deposit of limestone, alternate layers of the two materials can be burned in the same kiln and the product ground to form a puzzolanic cement. This mixed with suitable air entraining agent will expand, preferably in an iron mold, and on induraton will form a block of considerable value as a building material.

Supplying Ready Mix and Concrete Block Market

Fontana Gravel Co. sets up a plant for maximum recovery of sizes to meet ready mixed concrete and block requirements

By W. B. LENHART



Live storage bins, below, to the right, and rake classifier for sand, to the left

LATE in 1946 the Fontana Gravel Co. started operations at its new sand and gravel plant near Fontana, Calif. Fontana lies between Los Angeles and San Bernardino in the heart of the orange and citrus growing belt, and the plant is near the steel blast furnaces and steel mills of the Henry J. Kaiser interests. While relatively small compared to some of the other new plants in the southwest, it retains many of the advantageous features of the larger operations. It is of steel construction, and is a compact, neat and efficient unit. It was built by the company's staff and was designed cooperatively by the company's engineers and the Stephens-Adamson Co. The plant has a capacity of 100 tons per hour.

Triangle Certified Concrete Co., of San Bernardino, also has a ready-mixed concrete plant alongside the sand and gravel plant. The two ready-mixed concrete operators have a fleet of Rex transit mix trucks which are switched back and forth between the two plants as business requires, but ordinarily four of the Rex trucks are assigned to the Fontana operation. The ready-mixed concrete plant was built by the Triangle Certified Concrete Co., although most of the equipment in it was assembled by Garlinghouse Bros. of Los Angeles. Howe scales are used.

Loading attachment on Diesel tractor loading plaster sand into truck

Adjacent to the plant, the company opened up a pit that is characterized by little or no overburden. Gravel is relatively small so no primary crushing is needed, but a 2-ft. 4-in. Traylor secondary crusher is used to reduce the plus ¾-in. A ½-cu. yd. Bay City shovel loads to trucks that deliver the sand and gravel to the truck hopper. Material in the truck hopper flows to a Stephens-Adamson pan feeder and thence to a 24-in. inclined belt conveyor serving the dry screening section. The pan feeder is driven through a Reeves variable speed reduction unit. The belt conveyor discharges to a 4- x 8-ft. Tyler Niagara vibrating screen that operates dry. The top deck has a ¾-in. screen, oversize from which falls to the Traylor reduction crusher with the throughs returned to the primary conveyor belt by an inclined belt conveyor.

The lower deck of the Tyler-Niagara screen has a 4-ft. upper section of 3/16-in. cloth with no screen on the lower end. Minus 3/16-in. material is chuted to a stacker belt and the dry sand stockpiled. This dry material is much in favor for concrete block manufacture in the area. The oversize from the lower deck, which in sand-volume is considerably greater than the fines, falls to an inclined belt conveyor and is delivered to the wet screening plant. Under this screen is a "cutter" which is hand-set to take all or a part of the fines (minus 3/16-in. that usually goes to the dry sand pile), and place it on the main belt going to the washing plant.

Mounted over the three steel bins is the washing section which comprises a 4- x 8-ft. double-deck Tyler Niagara screen. The top deck has ½-in. wire, and the lower deck is divided into three sections. The top section has 3/16-in. wire, the middle section ¼-in., and the lower section ⅜-in. cloth. Fines from the two upper screens flow to a 24-in. duplex rake classifier. Sand from the rake classifier flows to a stacker belt. If it is desired to make plaster or concrete sand, the top decks of the screen are changed to the desired size and each sand has its own stacker belt. Thus the company makes three kinds of sand; (a) dry sand containing a considerable amount of fine material, (b) concrete sand and (c) plaster sand. All these sands are reclaimed by a McCaffrey loading attachment mounted on a "40" Caterpillar Diesel tractor. Any excess sizes of gravel are stockpiled by trucks and the material reclaimed by this same piece of equipment. This same fleet of trucks supplies the ready-mixed concrete plant alongside.

R. J. La Vergne is general manager of the sand and gravel operation in partnership with Neal 0. Baker, Jr. George Gade is plant superintendent. George Thwing, Jr., is general manager of the Triangle Certified Concrete Co., and Paul R. Thomas superintendent of the ready-mixed concrete operations.

By JAMES A. BARR, Jr.

Potassium processing plant of International Minerals and Chemical Co., Carlsbad, N. Mex. At the extreme left, in the background, may be seen the loading station and next to it the storage building; in the center is the cooling tower and refinery, with crushing building, head frame shaft, and water tower following in line

POTASH Concentration

Part 8: Novel processes used to separate water soluble crystalline salts by froth flotation methods

POTASH is one of our most essential non-metallic minerals. Although relatively a newcomer, potash concentration is of primary importance in our national economy, for it is used in ever increasing amounts by our fertilizer industry. In addition, potash chemicals were and are an absolute necessity to our national defense.

Prior to 1914 almost all of the world's supply of potash came from Germany and Alsace. Since the German government controlled production, allocation and price of the entire output of both the German and Alsatian potash mines, it is not in the least surprising that we entered World War I entirely cut off from all major sources of potash.

For the entire period of World War I, we had to depend on our ingenuity to increase production of potash from such sources as molasses distillery waste, kelp, cement and furnace dusts, alunite and silicate minerals and natural brines found in the dried-up lake beds of Searles Lake in California and Lake Bonneville salt flats in Utah. Appreciable quantities of potash were even produced from such primitive sources as wood ashes.

Total consumption of potash in the United States for the four years prior to 1914 averaged approximately 270,000 tons. By 1918 we had increased production until we were producing only one fifth of our normal requirements.

It was imperative that we find and develop our own source of low cost potash when the prewar German monopoly was revived by the Franco-German agreement of 1924.

During oil well drilling operations in the Permian Basin area of western Texas and southeastern New Mexico, cuttings from the thick salt beds were identified as potash minerals. It was then decided to further investigate the possibilities throughout the area by test wells. Drilling was begun in 1927 by the Federal Government and by late 1929, thirteen test wells had been completed.

Shuttle car unloading into elevator which is loading mine cars

The drilling proved the occurrence of large deposits of polyhalite, a complex sulphate of potash, lime and magnesia having an average composition $2\,CaSO_4, MgSO_4 \cdot K_2SO_4 \cdot 2\,H_2O$. The potash ($K_2O$) content of pure polyhalite is 15.6 per cent. In New Mexico seams of sylvinite, a mechanical mixture of sylvite (KCl) and halite (NaCl), carnallite ($KCl \cdot MgCl_2 \cdot 6H_2O$), kainite ($MgSO_4\,KCl\,3H_2O$) and langbeinite ($2MgSO_4\,K_2SO_4$).

Early government reports indicate that the polyhalite was found the most abundant potash mineral and the one with probably the greatest commercial interest.

Later churn drilling and core drilling on a more extensive scale proved very extensive tonnages of sylvinite near Carlsbad, New Mexico. These deposits were the most attractive to private enterprise and so became our first bid for independence from foreign potash monopolies.

New Methods Needed

European practice of solution, evaporation and crystallization, required a very extensive outlay of capital. Therefore simultaneously with the development of crystallization methods other processes were being thoroughly investigated.

It was fortunate that froth flotation of non-metallic minerals had proven so successful that the research flotation engineers were dreaming of separating anything and everything they could get their hands on by froth flotation methods.

However, to froth float a relatively insoluble mineral in water was one thing and to froth float a completely water soluble mineral, sylvite (KCl) seemed to be entirely another matter.

After the usual theorizing period, cut and try methods indicated that if the sylvinite ore is ground in a brine

saturated with respect to all the soluble components of sylvinite ore, then the ground liberated particles remain undissolved and may be treated in the same manner as a relatively insoluble mineral in water. By this procedure, crystals of KCl and NaCl are liberated from each other by grinding the sylvinite ore (KCl NaCl) in a brine saturated with dissolved NaCl (halite) and KCl (sylvite).

In addition to successful methods for the concentration of potash by crystallization, two distinctly different froth flotation methods evolved from many exhaustive but untiring research programs; a process utilizing long known anionic fatty acid flotation reagents to froth float the halite from sylvite and, a process utilizing a new class of cationic high molecular weight aliphatic amines to froth float sylvite from halite.

Our Principal Potash Sources

The major part of our domestic potash production which now (1947) amounts to the very impressive figure of 1,750,000 short tons of potash salts annually, comes from extensive horizontal beds of sylvinite lying almost 1000 ft. below the surface near Carlsbad, N. Mex. Above and below the potash lie very thick beds of salt.

These commercial potash beds which may range from a potash content of 15 per cent to higher than 25 per cent, are in striking contrast to our only other present commercial source—the natural brines.

Most ingenious of the methods which are practiced to concentrate potash from natural brines is the method used at Lake Bonneville, Utah. In the salt flat area, brine from an apparently endless network of canals is pumped into a solar evaporation system. The crude brine contains only about 1.2 per cent potassium chloride, 1.6 per cent magnesium chloride and 19 per cent sodium chloride. Solar energy equivalent to more than 3000 tons of coal is used each day to evaporate the water. This causes salt to precipitate out first and then a mixture of potassium chloride and sodium chloride crystals. The mixture of 1 part KCl to 2 parts NaCl constitutes the ore and follows normal flowsheet procedure as indicated for the froth flotation separation of sylvite from halite by cationic flotation reagents. It is truly an inspiring sight and awesome feeling to gaze over the many square miles of evaporation ponds where the energy of the sun is so successfully harnessed to do man's bidding at Lake Bonneville salt flats or to wander in between the gigantic evaporators and crystallizers used to concentrate the complex brines at Searles Lake.

Mineral Preparation

Whether the flotation feed is obtained by harvesting the mixed crystals from dry evaporation ponds or by mining solid ore underground, all minerals must be liberated before either an agglomeration or froth flotation process can be successful. For the agglomeration process, the minerals are first crushed through 8-mesh. At about 14-mesh the crystals are essentially liberated. The agglomeration feed nominally ranges between minus 8 and plus 35-mesh in particle size.

A typical flotation feed has approximately the following grain size distribution:

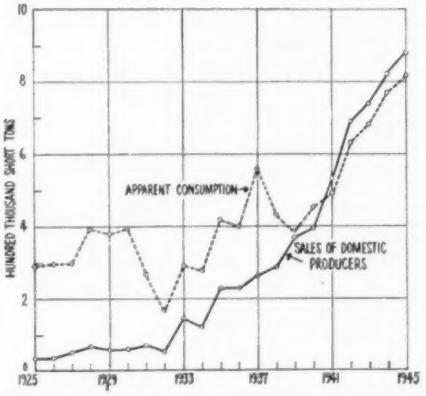
FLOTATION FEED—CATIONIC CIRCUIT

Mesh	Per Cent Weight Retained	Cum. Per Cent Weight Retained
14	1	1
20	4	5
28	14	19
35	13	32
48	20	52
65	15	67
100	12	79
200	14	93
—200	7	100

After dry crushing or wet grinding the minerals to the desired point of liberation, it is advantageous to reject a part of the natural insoluble slimes which are also liberated. These slimes were entrapped by the crystals of KCl and NaCl as the crystallization took place many millions of years ago. The slimes are present in appreciable percentage in natural ores, but are relatively insignificant in evaporated crystal mixtures.

Hydroclassifiers are used for this desliming step. Deslimed sands proceed toward the flotation section while the slimes are diverted to large thickeners. The settled slimes are withdrawn at a cautious rate and rejected from the clear, saturated brine system. Only saturated brine is used for desliming, conditioning, and flotation circuits, for it must be remembered that the solid crystals of sylvite (KCl) and halite (NaCl) would disappear into an unsaturated brine or fresh water as dissolved salts of sodium and potassium.

Interior of flotation plant. In the rear are the rougher cells, followed by cleaner and recleaner sections; to the left may be seen the agglomerate tabling section



Comparison of apparent domestic consumption of potash and sales by domestic producers in the United States, 1925-45. (U. S. Bureau of Mines)

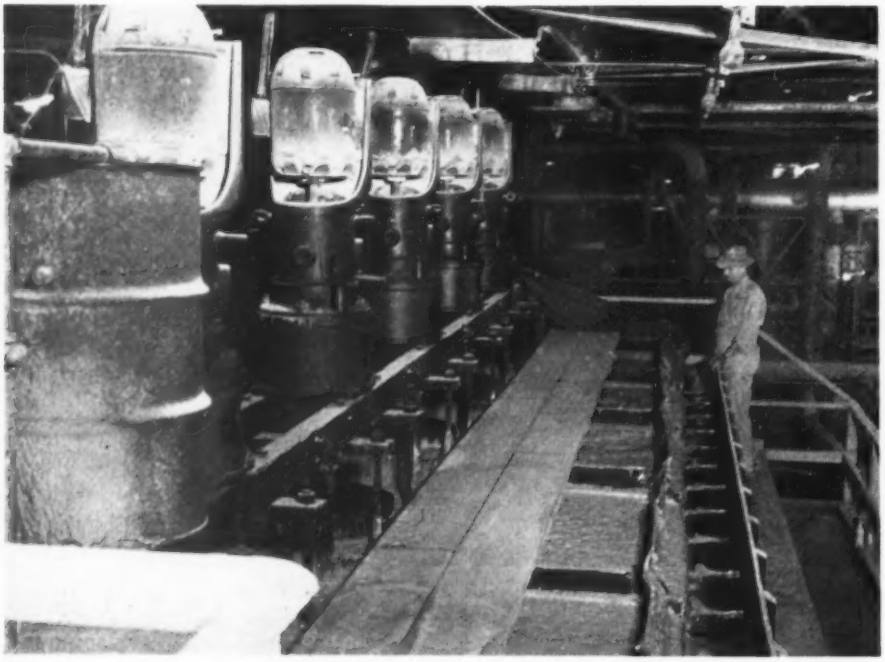
Conditioning Circuit

The reagents, whether anionic fatty acids or soaps, cationic high molecular weight amines or amine salts are all relatively insoluble in saturated brine. Therefore, the reagents must be brought into contact with the solid potassium chloride or sodium chloride particles by a conditioning period within an adequately agitated mixer capable of maintaining the solid crystals in suspension at between 30 per cent and 60 per cent undissolved solids. Conditioning time varies with the ore but normally requires between one and two minutes.

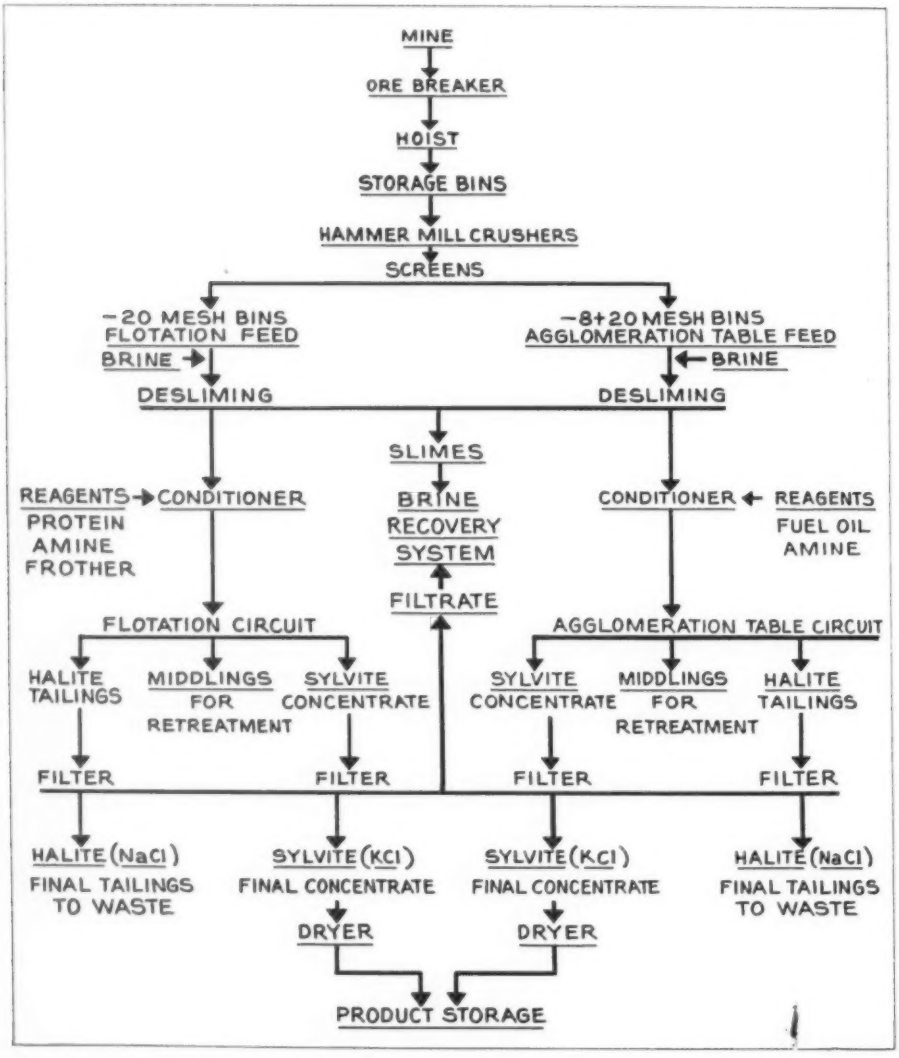
Agglomerate Tabling Circuit

Often a very coarse potash concentrate is desired for special agricultural purposes; the formation of agglomerates of very coarse potash particles at between 8-mesh and 35-mesh.

Although agglomeration was first successfully used to commercially



An addition to the flotation plant is the new turbo-floater unit taken from the conditioner-distributor platform and looking toward discharge end of the cell



Flowsheet for combination froth flotation and agglomeration separation of Sylvite (KCl) from Halite (NaCl) by cationic flotation reagents

process phosphate, the method also is utilized with equal success on coarse potash. The grade of product is somewhat lower than that produced by froth flotation methods.

Agglomerates are formed by coating the sylvite with a film of a cationic high molecular weight aliphatic amine and then sticking the filmed particles together with a crude hydrocarbon fuel oil. The agglomerated table feed is concentrated on reciprocating wet tables. And even though the mineral sylvite (KCl) has a specific gravity of 1.99 and halite (NaCl) has a specific gravity of 2.17, a difference of only 0.18, the agglomerated sylvite is easily concentrated in the table overflow stream while the unfilmed halite is discharged as a tailings from the end of the table.

Anionic Flotation Circuit

The purpose of any froth flotation process is the separation of one or more minerals to produce one or more salable concentrates. The method used is largely a matter of choice after due consideration has been given to process results and economics of the processes used.

Reagents required for froth flotation of the halite or salt and slime minerals are anionic chemicals. They may be selected from the fatty acids or soaps produced from natural oils or they may be selected from a number of synthetic products.

Metal salts are generally used to increase the floatability of halite, and after a normal conditioning period the flotation feed is sent through a rougher flotation circuit. Several cleaning and recleaning circuits are used to assure a high grade potash concentrate with the least loss of potash in the final flotation tailings.

Potash concentrate analyzing the required 95 per cent KCl is easily produced by this method and at a high rate of recovery, even though 60 to 80 per cent of the ore is rejected in a waste froth product tailings.

The Cationic Flotation Circuit

Most useful of the new flotation reagents are of the cationic type. High molecular weight aliphatic amines and their water soluble salts were found to be excellent collectors for acidic minerals, silica, silicates, and offered many new approaches to old troublesome problems.

The early research work proved that cationic reagents are excellent flotation reagents for sylvite, and with various modifications, a new process was developed to froth float the minor mineral or sylvite.

The amine salt selected after exhaustive study is a mixture of high molecular weight amine acetates derived from animal tallow. The amount required varies with the ore but is between 0.3 lb. and 0.5 lb. per ton of flotation feed.

After a short conditioning period,

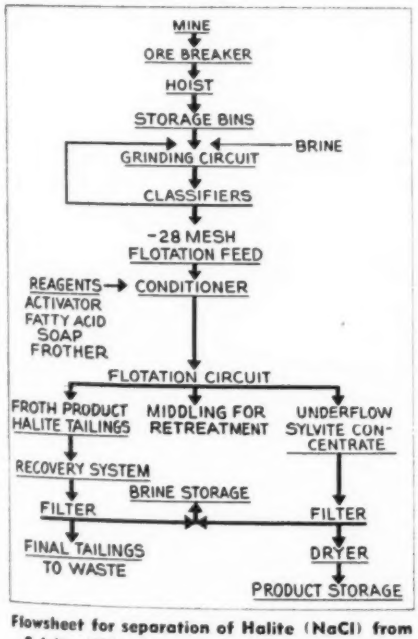
the flotation feed is treated in a froth flotation rougher circuit to produce a rough, relatively low grade froth sylvite concentrate. This rougher product is then cleaned a sufficient number of times to maintain a required 95 per cent KCl concentrate. A protein assures a high grade concentrate by reducing slime interference and flocculating the slimes as they are released.

A few of the significant points in this process are high recovery of potash mineral with a very short flotation period, and a corresponding increase in productive capacity per given unit area of floor space. Concentration of the minor mineral in the froth is always a desirable procedure and is very often an essential procedure as the grade of ore decreases.

Flotation Machines

Three flotation machines have been operating entirely satisfactorily for several years. They are, in order of number of cells in operation, the (Denver) Fahrenwald machine, the (American Cyanamid) Fagergren, and the International Turbo-floater.

Data* is available only for a comparison between the Fagergren and Turbo cells. It must be remembered in comparing data on these circuits that the flotation feed is sylvinite ore floated in a saturated brine. Sylvinite is a physical mixture of KCl and NaCl, having an average specific gravity of 2.0. The brine has an approximate specific gravity of 1.26.

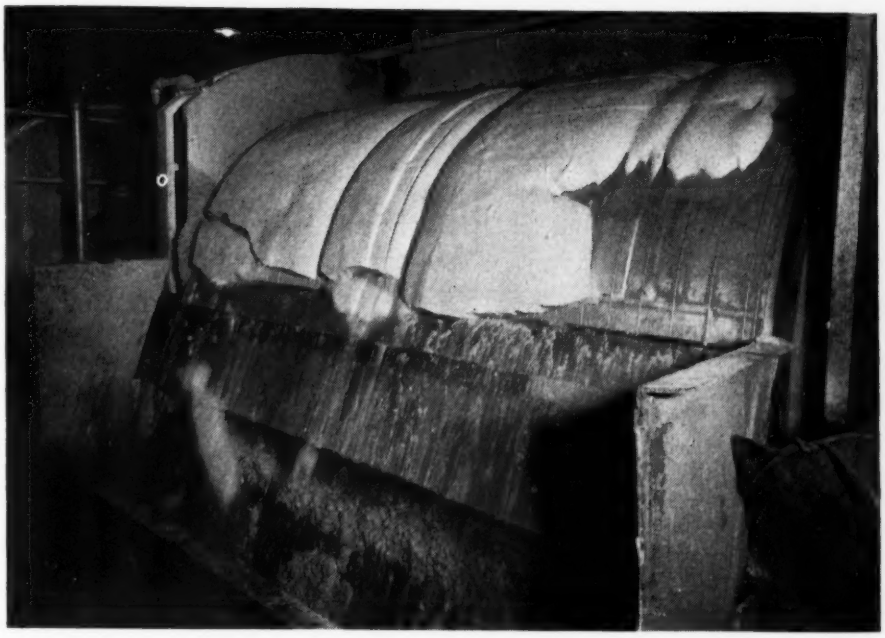


Flowsheet for separation of Halite (NaCl) from Sylvite (KCl) by anionic flotation reagents

*TP No. 1922, A.I.M.E., September, 1945. "Machines for Non-Metallic Flotation" by James A. Barr, chief engineer, International Minerals and Chemical Corporation.

The percentage solids in the pulp varies from 20 to 30 per cent.

The screen analysis of the flotation feed used during the flotation test was as follows:



Salt tailings filter in action

Mesh	Per Cent Retained	Per Cent Cumulative
+20	9.3	9.3
+35	31.0	40.3
+80	31.9	72.2
+200	19.2	91.4
—200	8.6	8.6

All types of machines used to date have given excellent performance, and it must be said that further experimentation showed that by decreasing the Fagergren impellor speeds their metallurgical efficiency was satisfactorily increased.

It has been my contention for many years that machine design plays a relatively small part, metallurgically speaking, in any correctly executed flotation process. Properly prepare the minerals for flotation and find the correct conditions for selectively filming the mineral with a specific anionic or cationic froth flotation reagent and it is most difficult to keep from obtaining a high grade concentrate by changing to a less favored machine design.

One of the greatest common mistakes is to attempt to make one machine do more than it was designed to do or to expect one type of machine to function under all the variable conditions found around froth flotation circuits.

The processes for separating water soluble potash salts, regardless of method used, are a tribute to the imagination and ingenuity shown by our research engineers—that group of practical dreamers who will play such an important part in our approaching atomic age.

DATA ON THREE ROUGHER MACHINES PERIODS OF OPERATION*

Data	Group A 1st Period	Group B 2nd Period	Group C 3rd Period
Comparative feed rate, per cent	100	134	146
Horsepower per group	35.0	37.5	37.5
Recovery K_2O, per cent	75.0	78.6	84.6

PARALLEL OPERATIONS OF TURBO CELL

Data	A Plus 18 in. Turbo	A Plus 27 in. Turbo	5 International Turbo Floaters
Tons feed per 24 hours	720	720	960
Percentage of solids	25	25	25
R.P.M. Fagergren, impellors	400/500x	400/500x	125x
Horsepower per group	35.0	37.5	37.5
Kilowatt hours per ton	0.93	0.93	0.70
Percentage of recovery	77.0	84.6	90.0

*Group A—Fagergren roughers, 14 S, type SS, 56 in. square cells, V-belt driven by 7½-hp. per cell, impellor speed 400-500 r.p.m.

Group B—Fagergren roughers plus the two turbo cells.

Group C—Same as Group B but with the International turbo cell in parallel. Trough type machine designed by engineering staff of I. M. & C. C., 27-in. turbo impellor used for aeration and agitation.

Pavement Yardage

AWARDS of concrete pavement for June and for the first six months of 1947 have been announced by the Portland Cement Association as follows:

	Square Yards Awarded During June, 1947	During First 6 Months of 1947
Roads	2,456,477	11,494,410
Streets and Alleys	1,559,525	6,246,478
Airports	211,861	838,881
Totals	4,227,863	18,579,769

New York Talc Mine

R. T. VANDERBILT CO., New York City, plans to open a new talc mine in northern New York state. The deposit to be mined is about 35 miles northeast of Watertown.

TRENDS In Cement Manufacture

Plant programs point to definite trend toward longer kilns and the wet process; more accurate control of raw material composition, and increased grinding capacity

By BROR NORDBERG

OUR ATTEMPT herein to outline current trends in the manufacture of portland cement stems from personal interviews with cement company executives, announcements of projected and already contracted plant installations; analysis of plant modernization completed in 1946 and 1947, and data received from company heads outlining latest developments and progress in plant construction and reconstruction.

In contrast with conditions a year ago when the editors outlined anticipated trends, a good number of plant building programs are underway, sufficiently to establish definitely the pattern for plant operations. No attempt is made here to itemize the many stallation, analysis of plant modernistarted; rather, they are used to point out where the greatest emphasis is being placed in revamping manufacturing methods and for what purpose.

High levels of production have prevailed in the industry the past several years and new production records undoubtedly would have been established in 1946 and 1947 if production could have been stepped up fast enough; but shortages of most everything, strikes, delays in equipment delivery and low labor productivity prevailed.

The industry is more aware than ever before of the challenge presented by inflated costs of labor, power and fuel in particular, and emphasis in plant modernization is concentrated on those high cost factors. Extraordinary demand and sales have enabled the taking of profits but cost increases have far exceeded price increases per unit of output, with the result that plant installations contemplate more normal conditions when efficiency of operation, not abnormal demand, will determine whether or not a profit can be made. Certain definite trends indicate that special recognition of quality considerations accompany moves to improve economy of operation.

Further, the industry anticipates continuing high demand for its product and is prepared to invest further sizable expenditures for new facilities and replacement to accomplish greater efficiencies and lower unit costs. While much investment is to attain economy of operation, and not greater capacity, apparently the capacity of the industry is in process of an increase in the neighborhood of some 20 million barrels annually. That figure is based mainly on increases to existing plants, some of which are being rebuilt entirely or stepped up sharply. The Ideal Cement Co. alone has a program of $10,000,000, involving six of its eight mills, that will increase capacity by 4,200,000 bbl. annually. Others, including Calaveras Cement Co., Permanente Cement Co., The Monarch Cement Co., Oregon Portland Cement Co., Diamond Portland Cement Co., are making or planning substantial permanent increases in capacity through major plant enlargement while a great number of concerns have programs to increase production materially through important installations in various existing mill departments.

New plants are projected or planned for Minnesota, Arizona, North Carolina, Arkansas and Texas (already announced in past issues of ROCK PRODUCTS); and some of the major programs at existing mills, involve

Two 9- x 314-ft. dry process rotary kilns as viewed from the feed end in an eastern plant

Six side-dump, semi-trailer trucks of 35 tons capacity and more handle quarry haulage at Calaveras Cement Co. plant, San Andreas, Calif. Four newest units have two-way double-acting hoist to permit higher angle of dump than single action hoists; heavier bodies of slightly larger capacity than previously installed units; and they are of walking beam construction to eliminate spring on semi-trailer and to facilitate dumping

complete rebuilding of plants such as the Portland, Colo., and Devil's Slide, Utah, plants of Ideal Cement Co. In addition to new manufacturing plants, distribution has been or is being extended by the construction of storage facilities and packing plants at strategic locations, among them Marquette Cement Manufacturing Co. at Chicago, Medusa Portland Cement Co. at Milwaukee, Permanente Cement Co. at Seattle, Wash., and Missouri Portland Cement Co. at Memphis, Tenn.

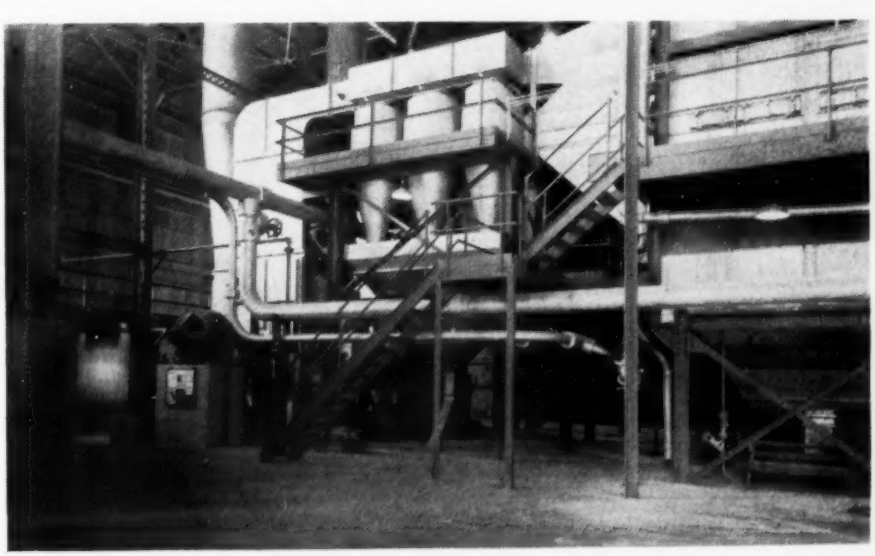
Expansion and renovation programs, in many concerns, are but part of long range planning and follow a common practice, among the smaller companies, of piece-meal rebuilding until, when ultimately completed, the entire mill has been rebuilt. The integration of the various departments, in such a program, constitutes the main problem in attainment of general mill efficiency. Currently, mills are pushed for production and, in some cases, major additions or complete rebuilding are proceeding adjacent to and in such a way as not to interfere with productive operation. Completion of new facilities, under such circumstances, may ultimately result in dismantling of the old mill, depending upon how well demand for cement holds up, in which case the increase in national capacity predicted may not be material several years hence.

As predicted in past issues of ROCK PRODUCTS, the cement mill of the near future will be a cleaner plant and an establishment with much more agreeable working conditions than heretofore. Packhouses have been the greatest source of complaint from labor and the cement industry is taking definite steps to make attractive the phase of plant operation that has been most troublesome from that standpoint; in fact, the modernization or building of packhouses has been the first postwar renovation step for many concerns. The nature and extent of those improvements will be discussed later.

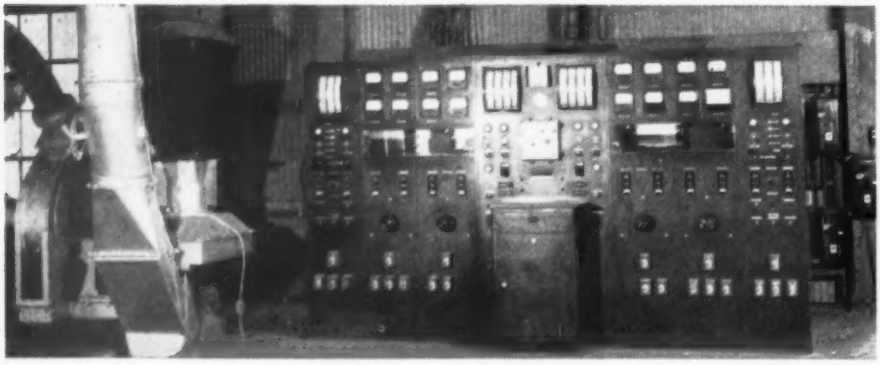
General layout of existing mills is not undergoing basic change but some new variations of the T or H design (See ROCK PRODUCTS, August, 1944, pp. 73-77, for discussion of plant layouts) are the basis for several of the new plants under construction. At least three and probably more of the entirely new projected enterprises will be wet process, and the two mills of Ideal Cement Co. previously mentioned are converting from the dry to the wet process, which would indicate the trend continues to be in that direction.

It is now recognized that blending in dry process plants can be accomplished to attain much more uniform composition of raw materials than was possible just a few years ago, so the continuing trend to wet process operation, as exemplified by the conversions mentioned and new plants, would indicate that the absolute perfection in blending, with available knowledge and equipment at hand, is sought. The industry has come a long way scientifically since the popular acceptance of quick setting cements in the 1930's with the attendant chemical and operational problems that were presented, and recognizes the need for uniformity not only in chemical composition of raw materials but in all plant operations.

It has been demonstrated that small changes in the proportions of the several raw materials that go into a mix can have important undesirable effects on "burnability" and economy of kiln operation to say nothing of the uniformity of product. An increase of one per cent, or less, of limestone in a mix requires harder burning, so blending apparently cannot be overdone and more attention is being given that phase of plant operation and to the attendant segregation in handling that can nullify the advantages of thorough blending. It is true that different forms of silica and alumina do not have identical chem-



Modern waste-heat boiler installation in an eastern cement plant. Battery of cyclone stack dust collectors and induced draft fan are visible on right; boiler and economizer on right



Example of an up-to-date electrical control panel for regulation of rotary kiln operation from burner's station. Instrumentation, indicating and recording, is finding wider acceptance in the cement industry

ical activity and react differently at various temperatures with calcium oxides in a rotary kiln so there are variables difficult to compensate for in large scale operation, but hydraulic methods of closed circuit grinding with rake or bowl classifiers and large thickeners are, in the opinion of many, the most accurate known method to grind and blend the raw materials that are available to a plant. The trend toward higher C_3S cements in recent years for high early strength purposes, with proportionate harder burning, has made very accurate control of composition a critical problem. Uniformity of particle size of raw materials has proved desirable for uniformity of kiln operation, too, and the closer the blend is to a given holding point the more the tendency to form mud rings and clinker rings is minimized. That has been proved in operations such as the Lone Star mill at New Orleans, discussed elsewhere in this issue.

Recognition of factors such as these is reflected in the addition of large thickeners and slurry storage tanks in plants now being modernized, and in the new wet process plants. Blending systems in dry process mills likewise are being perfected.

There had been a great deal of speculation recently as to whether it would be better to have kilns with separate power plants than to continue to operate waste heat plants, because highly efficient power plants had been perfected to a pronounced degree. Apparently, the preference is not established conclusively. If any thing, judging from installations now being made, the waste heat boiler is still regarded as an efficient method of economizing heat in the dry process. Modern waste heat boilers of greatly improved design are being installed in connection with relatively short kilns in quite a few plants, using heat recuperators and unit coal mills to complete an efficient overall kiln setup.

It is presumed that these new waste heat boilers have greater capacity than the boilers displaced; which in most cases had insufficient designed capacity to develop power to meet requirements that developed with finer grinding and other electrical requirements that were unforeseen at the time of original installation. One of the problems of recent years in waste heat plants has been whether to operate kilns to produce sound clinker at good thermal efficiency or for the purpose of developing power. In most cases, extra fuel was burned in order to minimize the amount of purchased supplemental power required and, as one operator of short kilns expressed it, the kilns were good stokers. The ideal would be to operate separate boilers in conjunction with each kiln, using separate flues, in order closely to control firing conditions.

In other instances, not too few to recognize, supplemental boilers are being installed as auxiliaries to waste heat boilers and at least two mills have installed separate power plants. One mill that we know of has gone to purchased power and several are installing large Diesel engines for power generation.

Completely new excavating equipment and Diesel-powered haulage units at Giant Portland Cement Co., Egypt, Penn. Diesel power is being favored for many quarries even with a relatively short haul

Kilns

A few of the dry process plants are installing new kilns, where the objective is greater capacity, but a great number of wet process kilns of considerable length are going into operation not only to increase capacity but, more importantly, to conserve fuel. When one considers that a rotary kiln is a furnace designed for manufacture of a chemical product, the range in lengths and diameters of the new kilns is amazing for their lack of any correlation. The only thing certain about them is that they are effective in reducing coal consumption markedly, along with the use of heat exchanger chains in the drying zone and other heat recuperation devices such as grate-type clinker coolers through which secondary air for combustion is preheated.

To emphasize the great variations in dimensions of new and projected kiln installations, for the benefit of those who would attempt to calculate expected production at assumed speeds, the following are the dimensions of some of the new kilns:

11 ft. 3 in. x 360 ft.
9 ft. 6 in. x 375 ft.
11 x 400 ft.
11 x 356 ft.
12 x 420 ft.
10 x 11 ft. 3 in. x 374 ft.
9 x 314 ft. (dry process)
7 ft. 6 in. x 10 ft. x 300 ft.
9 x 8 x 9 x 287 ft.
10 x 153 ft. 6 in. (dry process)
8½ x 10 x 8½ x 300 ft.
9½ x 375 ft.
9½ x 250 ft. (dry process)
10 x 300 ft. (dry process)
9½ x 324 ft.
11 ft. 3 in. x 450 ft.

This varied assortment of kiln sizes proves that the ideal dimensions of a rotary kiln are not known. Length of kiln is proportional to the time of travel through and contributes greatly to fuel economy, as we all know, and capacity is supposed to be a function of diameter mainly, which makes it impossible to interpret reasons for the selections of sizes listed. Comparative figures on capacities of long kilns and shorter ones of the same diameter and operated at identical speeds have demonstrated that diameter alone does not nearly determine capacity, apparently indicating that length must increase the efficiency of the chemical processing and contribute to capacity for that reason.

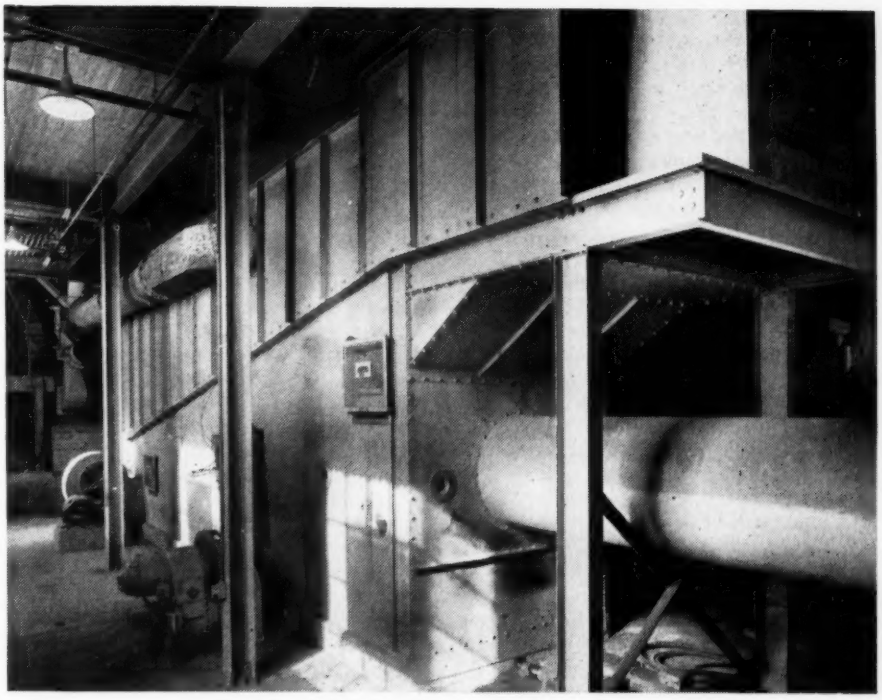
One reason why long kilns produce a uniform product, when properly operated, is that more intimate mixing goes along with length. There must be an important relationship between diameter and speed of rotation for the optimum mixing and blending along with the best exposure to heat transfer but, here again, the wide range of speeds employed even in the newer installations demonstrates lack of knowledge in kiln operation.

Of course, no two mixtures of different raw materials behave alike in burning, so fuel utilization and output for kilns between various plants can hardly be compared and therefore conclusions be drawn as to optimum size of kilns for two different plants let alone the entire industry. There are other factors, unrelated to thermal and chemical considerations, responsible for the sizes of kilns being installed; among them the fact that some kilns were purchased from other industries, geographical location and its effect on fuel prices and competitive cement prices, mill installation limitations, capital available for installation and future market estimates.

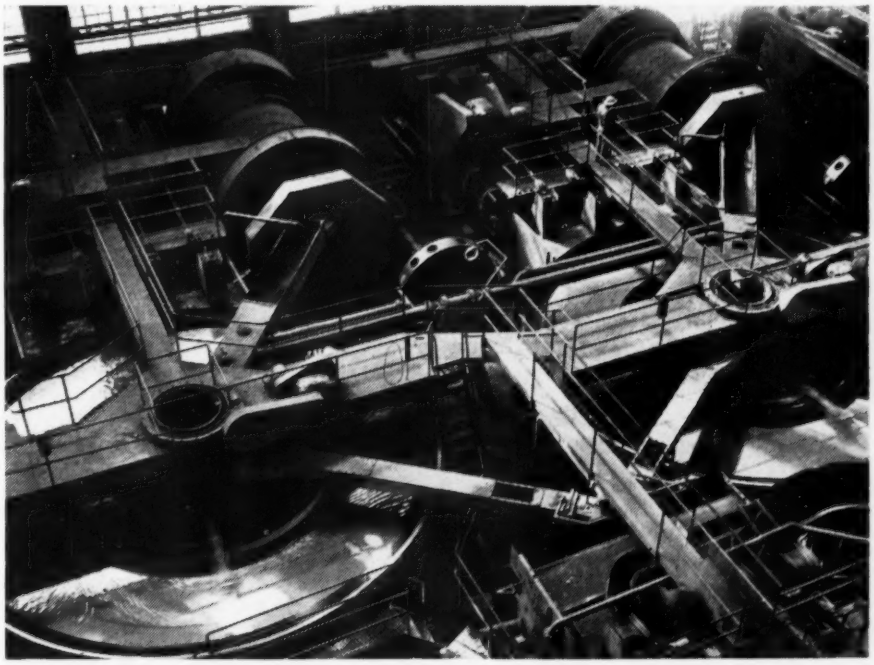
Klns over 300 ft. in length are in for a lot of research in plant operation but enough has already been learned of their sensitivities and whims that the industry has definitely decided that the long kiln is manageable and here to stay. Practically all the new long wet process kilns are equipped with heat exchanger chains in their evaporating zones and some will depend upon that auxiliary alone, along with the extreme length of kiln, for fuel economy. Apparently, length of chain and the design of the chain section must be tailored to each kiln and raw material, those having experience with such installations having experimented sometimes for years before arriving at an optimum system for their specific raw materials. It is of interest that some of the newer kilns have enlarged diameter drying sections, presumably for more effective drying in a shorter length of kiln.

Kiln speeds are a particularly lively subject at this time, and there is a definite trend toward higher speeds of rotation. Whereas a revolution per minute of kilns was an average speed a few years ago, apparently the new standard will be in the neighborhood of 75-80 r.p.h. Kilns are now being operated at 100 r.p.h. or higher, in a few instances, and evidently with excellent performance. They carry a flatter slope, usually 7/16 in. to the lineal foot, and a thinner bed of material fed through. In plants operating kilns at such speeds, greater average daily production is said to be realized because more uniform output is maintained day in and day out than at the lower speeds where the same daily figure may be attained but cannot be held every day. This suggests that high speed of rotation may, at least in part, hold the answer to the vexing problem of load fluctuation so common to long kilns.

Installations of long kilns and other



Inclined grate-type, air-quenching clinker cooler. Air-quenching clinker coolers facilitate handling, provide for preheat of combustion air, condition clinker for grinding economy and have proven advantages on the quality of product as determined by tests. Plant modernization provides for many such installations



Close-up of a two-stage raw grinding installation for a western wet process plant. This adaptation of mining hydraulic methods for grinding is being incorporated into a number of the mills being reconstructed or built new

equipment are being made for economical operation but, under today's conditions of demand, some of the economy is being sacrificed for capacity. Some wastage of fuel for capacities that preclude efficiency is being more than balanced by the profits from large scale, forced operation but when that situation ends the efficiencies for which such installations are being installed will be sought.

Most of the long kilns will be operated at a constant speed, however, and with synchronized rate of feed, leaving the firing rate as the variable for ordinary necessary adjustments. Experience has proved that a long time, as much as three days in some cases of extreme length, is required to bring a long kiln back in balance for normal production, once that balance has been upset.

Load fluctuation and mud rings continue to command the attention of operators of long wet process rotary kilns, but much has been learned by operators with years of experience, that will benefit the uninitiated. Uniform composition of raw materials, which are ground to a high degree of fineness, has proved beneficial according to manufacturers who have had opportunity to observe kiln performance changes that accompanied perfections adopted in fine grinding and blending.

Instrumentation and sampling are contributing to knowledge and methods as to how to minimize mud ring formation and accompanying load fluctuations, and how to operate kilns for relatively uniform output even in the presence of a certain amount of damming up inside kilns. At the Lone Star Cement Corp., New Orleans, La., mill, discussed in this issue, the use of a recording and indicating pyrometer just below the chain section has proved valuable in informing the burner when to anticipate load fluctuations so that he can prepare for heavy loads and the light loads that follow surges. At Marquette's 11 ft. 6 in. x 475 ft. kiln at Des Moines, Iowa, (see ROCK PRODUCTS, August, 1946, p. 98) regulation of slurry viscosity through the chain section so that the critical viscosity for deposition will occur at a certain point along the kiln where the whipping action of the chains is effective in removal, is the means of preventing mud rings. Sampling ports at regular intervals through the chain section portion of the kiln are the aids for regulation. Devices such as the aforementioned are valuable but uniformity of raw materials, chemically and physically, and uniform speed of rotation; uniformity of firing, draft and all factors related to kiln operation are extremely important. Segregation of chemical elements is related to nonuniformity of particle size and premature clinkering of easily fusible fractions, the extremely fine particles which partially fuse first, result in sticky conditions which create rings.

Fuel consumption and output of the various extremely long kilns, those of very recent date and of long standing operation, defy standardization. Differences in raw materials, moisture content, kiln speed and in the degree to which kilns are being pushed under forced draft are variables that account for discrepancies in production from kilns of various sizes. A kiln with a production of 3100-3200 bbl. of clinker, Marquette's 475-ft. kiln (operated at 67 r.p.h.), is expected to produce 3500 bbl. at 80 r.p.h. Production of 3600 bbl. from a 11 ft. 3 in. by 360 ft. recent installation is predicted by the company, while an 11- x 365-ft. kiln (Lawrence Portland Cement Co., Thomaston, Maine) with considerable service is producing some 2700 bbl., in turning at 56.3 r.p.h. Wet process kilns turning at 100 r.p.h., and measuring 10- x 300-ft., are known to be producing 2600 bbl. There will be a lot of conversions of existing kilns in all sizes to higher speed drives and, we expect, the new installations will be of relatively high speed range.

Forced production, at high speed of rotation and high through draft, does not make for efficient heat utilization but fuel consumption for the industry, per barrel of cement, is being reduced markedly or will be when economy is the main objective sought. A million B.t.u. or less is the goal achievable in wet process plants, 80 or 85 lb. of coal per bbl. in coal-fired plants, as compared to a 100-120 lb. previous standard. And, 850,000 B.t.u. per bbl. (65 lb. per bbl.) is being achieved in the latest dry process kiln (2) installation of Lawrence Portland Cement Co., Siegfried, Penn. Those kilns are 9 x 314 ft., the longest yet installed for the dry process, and are described in the June, 1947, issue of ROCK PRODUCTS, pp. 86-91.

Practically all of the new kilns will have devices for heat recuperation. There are many air-quenching type clinker coolers being installed now, which provide a source of preheated secondary air while rendering clinker friable and easier to grind and at the same time fixing magnesia into a glassy state that is extremely helpful in passing autoclave soundness tests. Other types of recuperators, integral with the kiln hoods, are being installed and some kilns are being equipped with slurry filters. There is a great deal of interest in automatic kiln operation and instrumentation, both indicating and recording, for control of burning operations, and closed type kiln hoods are being specified.

The 356-ft. Lawrence kiln at Thomaston, Me., (see ROCK PRODUCTS, March, 1947, p. 70) is a good example of what can be accomplished in fuel saving. Operating two 11- x 200-ft. wet process kilns, at one time coal consumption was 136-138 lb. per bbl. In 1929, after slurry filters were installed, coal consumption was dropped to 120 lb. per bbl. Unit direct-firing coal mills and other improvements followed to reduce coal consumption another 10 lb. Then, the two kilns were joined into one of 11- x 356-ft. and present coal consumption is 85 lb. per bbl. This kiln is the longest to utilize filters and is probably the only chain-equipped one to use filter cake feed. Direct-firing unit coal mills, as would be expected, are being installed in increasing numbers. Some of the units being specified are air-swept ball mills.

Grinding

The rotary kiln being the heart of the cement mill operation and there being a great number of new ones being installed, grinding capacity, both raw and finish, is being proportionately increased. In mills where kiln capacity is not to be increased, there are cases where grinding departments are being revamped for greater capacity at higher fineness particularly in the raw end.

There does not appear, from information presently at hand, to be a pronounced trend toward a particular method of raw grinding, insofar as mill types are concerned, but the majority of new installations will be closed-circuit operations. Plans provide for both single-stage closed-circuit grinding with hydraulic classifiers and thickeners, and two stage circuit grinding with rake and bowl classifier equipment. One outstanding installation will consist of 10 ft. 8 in. x 17 ft. tube mills in closed circuit with hydraulic classifiers, for single-stage grinding. Dry process plants will utilize mechanical air separators in closed circuit with either compartment or tube mills according to limited information at hand.

Two-stage grinding of clinker seems to be preferred in new installations and clinker crushers ahead of milling operations are to be installed in many mills to improve grinding performance. Ideal Cement Co. will utilize 8- x 40-ft. compartment mills in closed circuit with mechanical air separators at the two plants being rebuilt. In other cases, roller-type preliminators are to be followed by tube mills in closed circuit with mechanical air separators. Special mills are being installed for grinding masonry cements, in a few cases, and in other plants for grinding high early strength cement so that existing equipment can be kept grinding other coarser ground cements. Stage grinding, of course, is instrumental to high increase in the output of the finish mill. It is of special interest that a large midwestern mill soon to be rebuilt has provided for open circuit grinding through finish mills, following closed circuit grinding through preliminary mills. There will be two double-stage grinding circuits each consisting of a 9 ft. 6 in. diameter by 11 ft. preliminary mill closed circuited with screens fol-

lowed by an 8 ft. 6 in. by 36-ft. finish mill. Doubtless, a graded final product without considerable deficiency in the small micron sizes, which extremely fine particles some experts claim are desirable, is the objective.

Packhouses

As pointed out earlier, the packhouse and storage facilities for cement have come in for much modernization. At least 25 such installations are in process of building or rebuilding or soon will be, with more to be effected soon. All are of the silo storage type with new, high-speed packing machines, and the emphasis, in design, is to enable packing various cements without contamination. Wire mesh conveyors for handling packaged cement to cars, first introduced by Universal Atlas, are being specified, in the interests of cleaner packages. Newer plants such as the Memphis terminal of Missouri Portland Cement Co., discussed in this issue, have dust collectors and provide clean, agreeable working conditions.

Dust Collection

Dust collection systems are being installed throughout cement manufacturing plants, as well, and there is a surprising number of high efficiency collectors being installed for stack dust collection in order to achieve dust collection efficiencies in excess of 90 per cent. Many electrical precipitators are going into service, as well as the cyclone type, not only in areas that have been subjected to complaints of dust nuisance, but in an effort to clean up operations and, wherever practicable, to reclaim valuable dusts for kiln feed. In at least one plant, a combination of a cyclone type collector in series with an electrical precipitator, is being installed, which not only has high efficiency expectation but the separation of dust according to particle size, which is possible, has interesting possibilities where the presence of considerable alkalies in raw materials makes it undesirable to return all the dust into the kilns. Alkalies are concentrated in the finer micron sizes of the dust, which would indicate that the comparatively small fraction embracing the finest particles could be separated and be discarded or sold for fertilizer.

Quarrying

Much capital investment is going into excavating equipment and quarry haulage units, necessitated by increased mill demands and obsolescence. Most of the new power shovels are in the 2½-cu. yd. to 4-cu. yd. range, with Diesel or electric power. New, rubber-tired haulage equipment is largely to be powered by Diesel engines, and is in the size range between 10-cu. yd. and 20-cu. yd., with the notable exception of the large 35-ton capacity, and larger, units of Calaveras Cement Co. shown herewith.

Miscellaneous

Several mills are starting the manufacture of new masonry mortar cements and are installing equipment for that specific purpose. Coolers to reduce cement temperatures to the 100-125 deg. F. range are being incorporated into some existing plants. There are new developments in material handling, specifically for the cement industry, and not as yet announced that are of interest and are being specified. One is an air-lift system whereby kiln feed materials are fed into the kiln feed spout under constant head through delivering to screw conveyor, in order to insure uniform rate of feed, and several such units already have been installed. We presume they are applicable to the feeding of grinding mills, as well.

The foregoing has dealt largely with major developments and trends, not attempting to consider all details of plant operation or makes of equipment by any means, but the following excerpts from a few letters received in reply to our request for latest information indicate in some detail specific plans, new ideas and developments for individual mills. Many other makes and types of equipment are, of course, being installed.

From a dry process plant in the East:

"At the present time we are installing four Fuller air-quenching coolers of the latest design and, in connection with the installation of these coolers, we are lengthening our three 8- x 120-ft. kilns and our 9- x 6- x 120-ft. kilns 40 ft., making them all 160 ft. in total length. The decision to lengthen the kilns was not to increase the capacity of the plant, but was principally due to the fact that it was the cheapest way to make a modern cooler installation. In addition to the saving expected from the coolers, we figured that a considerable better fuel saving could be made with this additional length. This work is now under way and two of the kilns have been lengthened, two of the coolers installed, and work is continuing on the other two units.

"It is also planned to install an air lift and constant head feeders for handling the coal on the four kilns. We are also working on the installation of a new finished grinding mill, which will be operated in closed circuit with Sturtevant air separators and Fuller Co. cement coolers.

"The principal reason for installing the additional mill is for grinding high early strength cement and masonry mortar. The installation of the mill will eliminate the changing of the present mill charges and adjustment of our present separators. It will also give us a larger finishing mill capacity, which will enable us to do a considerably higher percentage of grinding on off-peak power rates.

"We are also working on layouts for a new coal pulverizing installation, considering both the bin system and unit mill system, which will require a great deal of additional study. With the longer kilns, and the installation of the coolers, which will mean a considerably higher temperature of primary and secondary air, we feel that a considerably higher percentage of anthracite coal can be used than at the present time. This percentage must be determined before details of the coal installation can be decided upon and it is planned to go ahead with this work some time in the near future.

"Considerable additional equipment has been purchased for our quarry and yard operations, such as gasoline-operated shovel, and new trucks."

Eastern mill—wet process:

"At the present time, we are working on a new drying installation, for drying flotation plant rejects which are sold to various users of ground rock products.

"The engineering work is being completed, and two new Fuller air-quenching coolers will be installed next winter. These coolers are replacing the old original air-quenching coolers installed six or seven years ago. The original coolers were short and were used as air quenchers and recuperators, but were not of sufficient length for total cooling. In fact, they were the first coolers ever built by the Fuller Co.

"The equipment has been installed on one kiln for handling the stack dust collected by the Cottrell system. This is working most satisfactorily and equipment has been purchased for the installation on the second kiln.

"We have also purchased an additional gasoline-operated shovel for stripping, and several new trucks for stripping operations, as well as for hauling rock from our quarry operations to the crusher house."

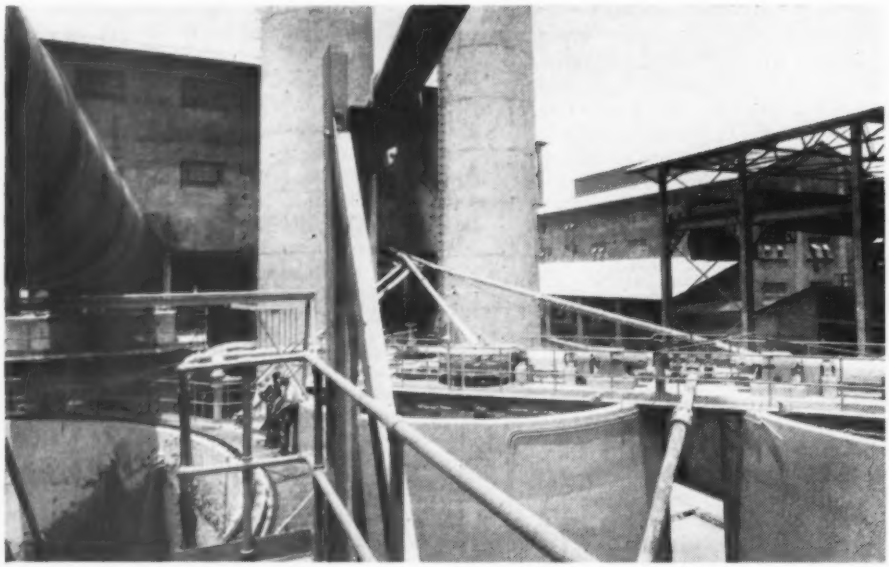
Southern mill—dry process:

"We have replaced our old waste heat boilers with new waste heat boilers of a greatly improved design; a subsidiary feature of this job was a boiler feed water treating plant. We still regard the waste heat boiler as the best way of economizing heat in the dry process. However, this view is subject to change with further developments. We have therefore kept relatively short kilns which were equipped some years ago with Vanderwerp recuperators and unit coal pulverizers.

"We have increased our tube mill equipment for raw material grinding, not with a view to greater kiln production but for the purpose of giving the kilns a finer feed which improves quality decidedly and also it has given some increased output. We have quite a satisfactory system for proportioning and blending our raw material which was installed some years ago.

"We have equipped the air separa-

(Continued on page 164)



Back end of 374-ft. kiln, showing slurry tanks in foreground

LONG KILN vs. Short Kiln Performance

Lone Star Cement Corporation, New Orleans, La., plant operating one long and two short kilns makes interesting study of comparative operating data

By BROR NORDBERG

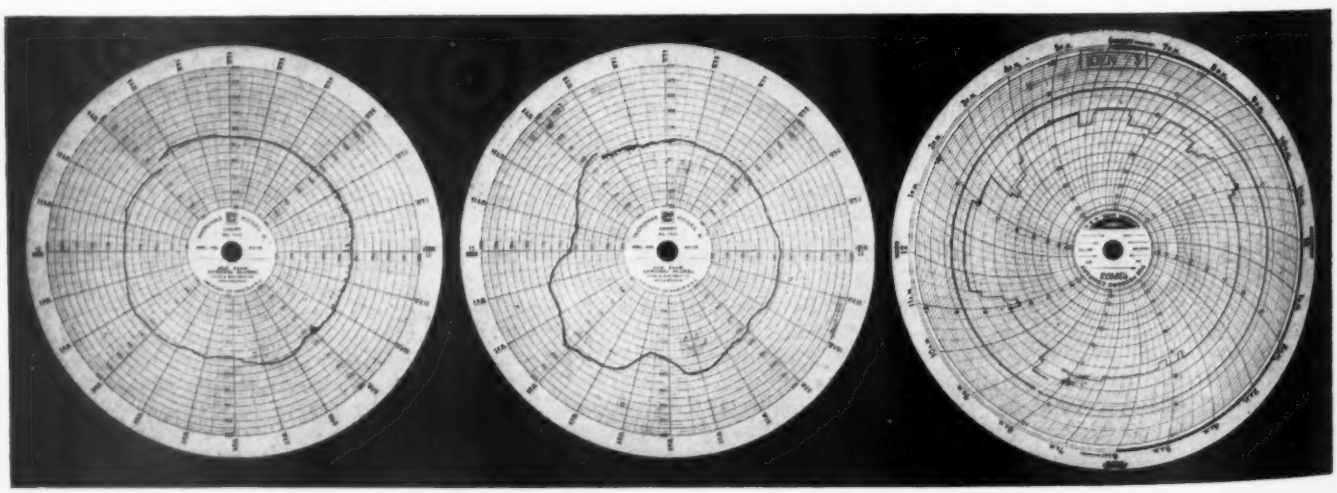
ANY fair consideration of the comparative performance of long rotary cement kilns with those of much shorter length and smaller diameter usually is difficult or impossible because kilns of great difference in dimensions rarely are operated under circumstances that permit comparison. They nearly always are located in different mills and therefore are fed different raw materials, which have variations in composition and fineness; and the fuels, firing practice and all of the other factors that influence performance are variables that cannot be weighted to determine relative operation.

Lone Star Cement Corporation's wet process mill at New Orleans, La., is one of few that operates both very long and relatively short kilns under exactly identical conditions of feed materials, fuel and standardized mill practice, thus affording an opportunity not only to consider relative economy and output; but general performance and continuity of operation, as influenced by load fluctuations and the frequency and extent of mud ring and clinker ring formation. The kilns at this plant have been in operation for many years and the long kiln, in particular, has undergone continuous study and experiment which have perfected its performance to a degree of satisfaction that Lone Star, in its present expansion program at New Orleans, has provided for installation of an exact duplicate kiln.

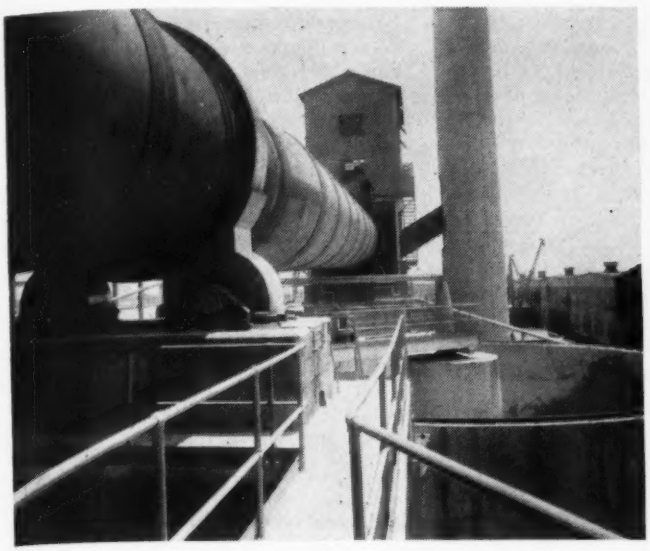
The Kilns

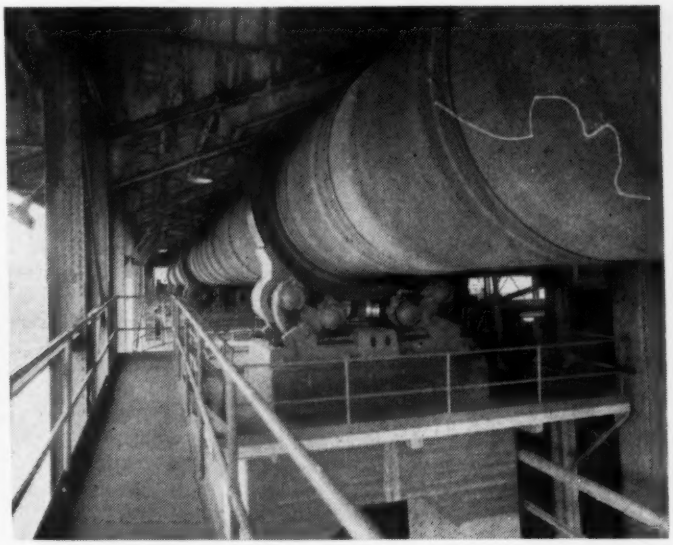
Two 8- x 9- x 219-ft. rotary kilns (Nos. 1 and 2) went into service in June, 1927, at the time the plant was built, and the long kiln (No. 3) has been in operation since 1930. It measures 374 ft. 4½ in. overall, with an enlarged drying zone 11 ft. 3 in. in diameter by 102 ft. 6½ in. in length, including the taper, and the balance is 10 ft. diameter. They are uninsulated kilns and lined with 70 per cent 6-in. alumina brick in the hot zone followed by 50 per cent alumina brick and 40 per cent 4-in. brick to the extreme ends of the kilns. All three kilns are equipped with chain heat exchangers in the drying zone and each is sloped ½ in. to the lineal foot.

Individual slurry boxes for each kiln are delivered a generous surplus of slurry to insure a constant overflow and a uniform slurry level. The ferris wheel slurry feeder for kiln No. 3 is driven through a sprocket and chain from the kiln shell and through proper gear reduction for automatic synchronization with kiln speed. On kilns No. 1 and No. 2, the slurry feeders are direct-driven by individual d.c. motors, the ferris



Left: Typical actual chart showing continuous temperatures as recorded from thermocouple 125 ft. from feed end of kiln. Uniformity indicates that load coming through is uniform. Center: Another temperature chart showing temperature inside kiln, also 125 ft. from feed end. This chart shows variations due to mud ring build-up and resulting load fluctuation. The sharp drops in temperature indicate that a ring has been discharged coming through the chain section. Right: Gas flow chart for same day as Micromax chart, No. 2 in center illustration, showing gas flow variations conforming with load fluctuations as indicated to operator from Micromax chart





Left: Feed end of 374-ft. kiln. Note enlarged diameter drying section, sprocket-chain arrangement to regulate feed (extreme end). Kiln feed tank and agitator below, showing overflow pipe return from ferris wheel feeder. Right: View of same kiln, looking toward firing end

wheels having adjustable buckets permitting just enough feed for proper burning. The synchronized feed arrangement on kiln No. 3 is much preferred for uniformity. Feed pipe are 4-in. inside diameter, 8-in. outside, and are not water-jacketed.

Kiln speeds are limited by necessity to the range of the existing drive equipment and therefore are not as fast as they might otherwise be to approach the current practice of speeds as high as 75 r.p.h. Kiln No. 3 turns at 52 r.p.h. and the others at 58 r.p.h.

Each kiln is operated on induced draft, pulling heated air for combustion through individual rotary clinker coolers, two 8- x 80-ft. and one measuring 9- x 80-ft., which discharge to a common skipulter which in turn transfers clinker at 200 deg. F. to an enclosed bucket elevator to storage. Natural gas is the fuel and high pressure burners (described later) are being adopted as standard practice. Raw materials are a 94 per cent $CaCO_3$ soft limestone quarried at St. Stephens, Ala., and clay overburden from the quarry, which are blended and ground to 92.5 per cent minus 200 mesh and fed into the kilns at 47 per cent moisture. Free lime and magnesia are practically non-existent and alkalis are not a consideration.

Operating Data

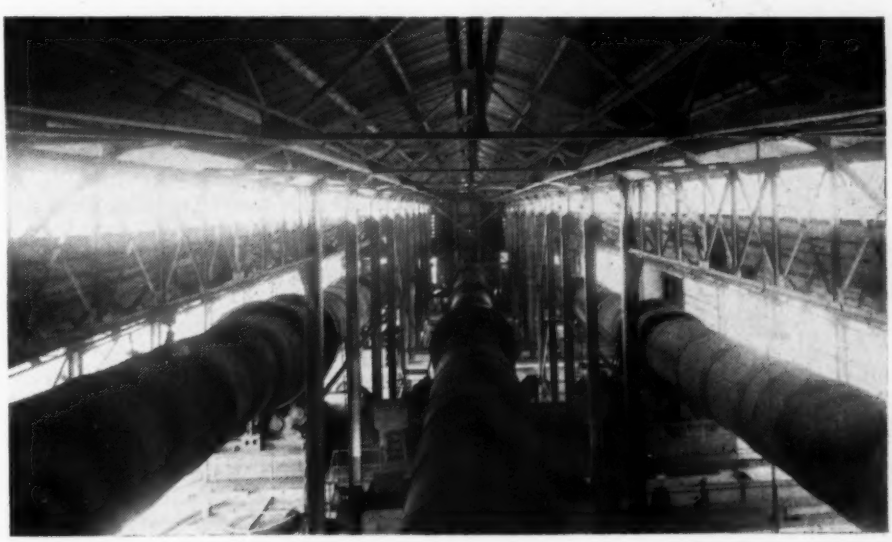
Operating data for these kilns are only of interest for comparing them, respectively, and can hardly be compared to performance as measured by figures in any other plant because of the nature of the raw materials. Clay in the raw mix, as compared to shale, necessitates higher fuel consumption and results in lower production. The particular clay used at Lone Star has very unpredictable characteristics that not only necessitate the feed of abnormally wet slurry but complicate kiln operation and handling.

Under average conditions, the slurry must have not less than 47 per cent moisture in order that it have sufficient fluidity to overcome its tendency to stickiness. Stickiness is a factor in mud ring formation as well as in feeding the kilns. At lower consistencies, the slurry will stick in the ferris wheel feeder buckets, and a drop of only a few per cent in moisture will reflect in non-uniform kiln flow. Practice is to make moisture determinations at 2-hr. intervals and, periodically, the feeder buckets and feed pipe are washed.

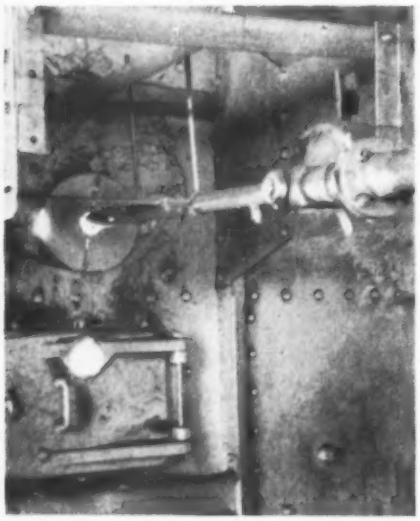
Production of the large kiln averages 86 bbl. of clinker per hour as compared to 47 bbl. per hour for each of the short kilns. On the average, 1,430,000 B.t.u. are consumed per bbl. of clinker, comparing with 1,680,000 B.t.u. for the short kilns, or a saving of 250,000 B.t.u. per bbl. Heating value of the fuel is 1100 B.t.u. per cu. ft. of gas. There is no difference, chemically, in the product from the kilns. Physically, the clinker from No. 3 kiln is slightly larger which is being anticipated in the installation of the duplicate kiln. A gyratory crusher wil be provided for size reduction ahead of milling.

Kiln No. 3 is much more sensitive and difficult to operate than the shorter kilns. Any changes to kiln speed or in rate, fineness or composition of feed material are reflected earlier and to a greater degree in the long kiln. For example, should the moisture of the slurry drop only a little under 45 per cent, a tendency toward balling up and building into a mud ring will be detected earlier in the long kiln and soon become evident in load fluctuation. Even the slightest change in kiln speed will have a bearing on uniformity of flow through the long kiln. All the kilns are now operated at constant speed, unless there be a radical condition requiring change, and the rate of firing is the only ordinary variable.

Mud rings and clinker rings were a



View of all three rotary kilns, looking toward firing end; 374-ft. kiln on left, with two 219-ft. kilns to the right



High temperature gas burner recently installed

Thermocouple near end of chain section for measuring temperature, wired to control board to indicate existence of load fluctuations

Trolley take-off to control board when temperatures are recorded as determined by thermocouple inside kiln at point close to end of chain section

serious handicap to operation some years ago, but have been minimized over the years through general tightening up of the overall operation as experience accumulated, to the point where load fluctuations and rings are no longer a serious factor. Clinker rings occur at intervals in the short kilns, but they usually drop out, and actual shooting out of a ring is made necessary only about once a month. The arrangement of heat exchanger chains adopted through years of experience has been a major factor in eliminating shutdowns for mud ring removal from all of the kilns.

Mud rings once were a costly occurrence, at one time requiring the shutdown of kiln No. 3 as frequently as every other day for their removal, but the application of greater knowledge of the control factors has eliminated any shutdown specifically for the purpose. The chain arrangement adopted has contributed much toward eradicating mud rings but, over and above that, uniformity of operation has been the greatest single factor in the solution of a very vexing problem. Uniformity of flow, of raw material composition, of high fineness and smooth, even kiln operation were the answers. Radical changes in kiln speed, or firing, or draft conditions had to be eliminated. Erratic changes in kiln speed even with synchronized rate of feed caused variable flow through the chains because a uniform rate of drying, under those conditions, was impossible.

Mud Rings

This general tightening up of operations consisted of certain mill changes and more vigilance in inspection and control throughout. Small amounts of contamination in the raw materials, due to pockets and seams in the quarry, contributed to both clinker ring and mud ring formation, resulting in the adoption of greater care in operation of the quarry. Certain changes in raw grinding made some years ago were instrumental in reducing ring trouble. Straight open-circuit grinding through kominuters followed by tube mills was the early practice, and large sized material often necessarily was fed to the kominuters. A hammer mill was introduced ahead of the kominuters to break down large stone pieces and a double system of tube-milling slurry was substituted. Slurry is ground through two kominuters in circuit with a screen followed by tube-milling and pumping into correcting basins. After correction, it is pumped back for grinding to 92.5 per cent minus 200-mesh through a second tube mill and then pumped into the kiln feed tanks. Uniformity of composition and fineness resulting from that mill change proved of measurable help in the evolution of practice that led to minimization of ring troubles and their attendant fluctuating loads. A better understanding of the raw materials, particularly the unpredictable characteristics of the clay in use, was no small factor.

Years ago doors had to be provided in the kilns at the lower end of the scraper chain section so that ring buildup could be observed and the material barred out; now the only mud ring removal is one of 6- to 8-in. thickness, some 20 ft. in length, that has a tendency to build in the upper end of the chain section and which is dislodged only when the kiln is down for re-lining or some other purpose.

Chain Systems

Plastic nature of the clay mix with its high moisture content resulted in an unpredictable flow through a chain system, and many chain arrangements had been tried. Many of them resulted in merely shifting the ring up or down the kiln according to the moisture contained at specific locations. Slight changes in the footage of a chain system, or in the amount of feed, intensified load fluctuation and the frequency of mud ring formation a great deal, indicating that a chain system must be designed according to individual conditions existing in connection with a given kiln.

The conveying action of a chain system and an arrangement so as not to retard material flow were important considerations in the system now adopted as standard. An enlarged diameter drying zone has been found to permit large chain surface without too long a chain system, with attendant high dust losses, while permitting good conveying characteristics through the kiln.

Various arrangements of evaporator and scraper chains were tried, also scraper rails, but the system now in use, consisting of evaporator chains followed by scraper chains and more evaporator chains, to form an interlaced loop system, has proven most

Recording temperature recorder for temperature within kiln as measured by thermocouple near end of chain section

satisfactory in all the kilns and will be installed in the new long kiln.

It consists of hanging the evaporator chain ends to circumferential hanger rings 4 ft. apart along the kiln shell, the chain being attached to alternate rings. Sufficient length to form a loop is provided and so that the interlaced system will maintain 32-33 in. clearance between the brick lining and the lowest point of the chain loops.

As recently installed in kiln No. 3, from the feed end of the kiln, there are six loops of 42 chains per ring, ⅝ in. chain, in the evaporating section covering a distance of some 28 ft. along the kiln shell. Following is 53 ft. of length in the scraper section with four 58-ft. lengths of 1¼-in. coil-proof chain and a second section of evaporator chains, seven loops, of 36 chains and 18 chains to a ring. Overall length of the chain section is 117 ft. and total footage is 7045 including the four scraper chains. Moisture content of the slurry is 17-19 per cent leaving the chain section. Uniform daily gas flow charts and Leeds-Northrup Micromax readings which indicate temperatures within the kiln at a point just following the chains generally show smooth flow through the chain section.

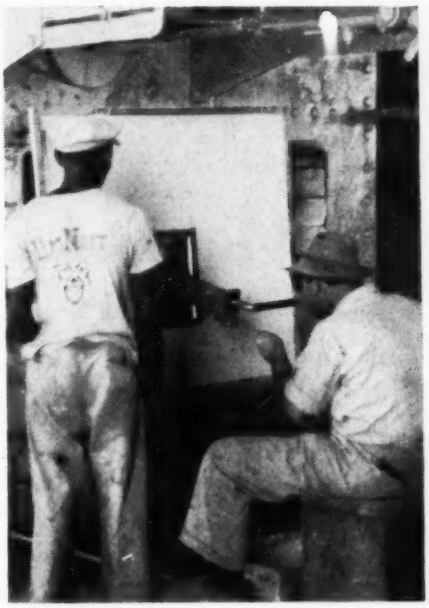
Kiln Operation

Kiln No. 3 is operated at 1.2 to 1.3 in. of water gauge, as measured just inside the feed end and the two short kilns carry 2.4 to 2.8 in. of draft. Exit temperatures range from 500-520 deg. F. for the long kiln as compared to 650-700 deg. F. for the short kilns.

As mentioned earlier, the kilns are operated at constant speed, rate of firing being the variable in kiln operation. Clinker is burned at approximately 2800 deg. F. and is considered a hard-burned clinker.

The kilns are not highly instrumentalized, the chief instruments being indicating pyrometers for back end temperatures with an alarm to indicate temperatures too high for the chains; draft indicators; and indicating tachometers. Kiln No. 3 has, in addition, a recording and indicating Micromax for the kiln temperature as measured by thermocouple at a location 125 ft. forward from the feed end of the kiln, an ammeter to indicate draft fan load; variable speed control; ammeter to indicate load on the kiln drive motor; and louvre damper draft control.

The Micromax with its thermocouple a short distance below the discharge end of the chain section has proven valuable apparatus as an indicator of load conditions at a critical point in the kiln and is to be installed in connection with the new kiln soon to be placed. A constant, or nearly constant, temperature as recorded on the Micromax is a positive indication that flow is uniform through the kiln.



Shooting out a clinker ring some 35 ft. back inside 219-ft. kiln

A sharp deviation from a figure of approximately 1000 deg. F., as indicated by the thermocouple, is a guide to the kiln burner as to changes in the kiln load that he must anticipate. A drop in temperature indicates that ring, or buildup, has come through the chain section and a rise indicates that a light load has passed the thermocouple. Knowing the time required for travel through the kiln from the thermocouple location, about 1 hr., 15 min., the operator prepares for an adjustment of the firing rate in anticipation of a heavy load coming down the kiln and for the light load that follows release of a dam. Another important indicator of load conditions is the depth of the slurry in the back end of the kiln, which is measured in inches hourly. A low and consistent level indicates uniform flow while a high reading is evidence that material is damming up behind a ring.

When the plant was originally built, the kilns were fired by coal. They were later converted to oil and have been fired by natural gas for a number of years. An important improvement in firing has been the recent conversion to high pressure gas firing, through simple steel pipe to which burner nozzles have been threaded. Nozzle gas pressure is 12 p.s.i., reduced from a supply pressure of 17 p.s.i. Air-cooled and water-cooled burner pipe were tried at first but discarded in favor of the simplified, uncooled burner pipe that is mounted with its nozzle just inside the kiln, to project a 30-ft. flame that does not impinge on the kiln lining or its load. A 2½-in. pipe for No. 3 kiln has a 2.3 in. orifice, and 2-in. pipe with 1.78 in. orifices fire the shorter kilns. They are adjustable, vertically and horizontally, and are mounted 6 in. off to one side of the center line of the kiln. All the preheated combustion air drawn up through the clinker coolers by the draft fans is in effect primary air.

Adoption of the new type burner has had several advantages. The old primary mixing chambers and 50-hp. and 75-hp. primary air fans, with their downtime for maintenance and their high power consumption, have been eliminated. Maintenance of burner tips has been reduced since primary air, for the mixing chamber, with the clinker dust it carries, is no longer required. Lighting a kiln is simple; there is no puffing out the kiln hood and a much cleaner burning floor has resulted.

Conclusions

Long kilns have proved their economy of operation everywhere but it remained for Lone Star to perfect operation of the No. 3 kiln at New Orleans, with its perplexing raw material, to a practical degree by the elimination of operating difficulties which would otherwise have nullified fuel efficiency benefits. It is a tribute to the plant operating personnel that an improvized kiln with enlarged drying zone, as originally installed, was so improved in performance through plant research and experimentation as to justify selection of an identical all-welded kiln for the plant expansion now underway. New raw grinding and finish grinding capacity will be installed to accommodate the increased capacity of 2000 bbl. of standard portland cement per day.

Plant personnel comprises A. D. Stancliff, general superintendent for the New Orleans, Birmingham and Spocari Divisions of Lone Star, who has actively been engaged in the supervision of plant operation at New Orleans for many years; W. W. Deadman, superintendent; and W. J. Gunn, chief chemist.

Laws Governing Concrete and Cinder Block

CONCRETE AND CINDER BLOCK manufacturers met in Raleigh, N. C., recently, to discuss laws enacted by the state legislature. One of the laws, to become effective July 1, requires that all blocks or other masonry units have a load-bearing strength of at least 700 lbs. per square inch upon delivery.

Fire Destroys Mixer Trucks

GENERAL SAND & STONE CORPORATION, Mamaroneck, N. Y., lost eight mixer trucks in a garage fire recently. The damage is estimated at $100,000.

Adds Ready Mix

THE MOUNT CARMEL SAND AND GRAVEL CO., Mount Carmel, Ill., has added a ready mixed concrete division to its plant.

Barge Haulage and New Terminals Extend Cement Markets

Missouri Portland Cement Co. has a versatile distribution terminal at Memphis, Tenn., and utilizes long pipe lines for loading barges at St. Louis dock and for unloading at destination

New Memphis terminal with rail shipping facilities and dust collector in the background

MEMPHIS, Tenn., has become a large volume distribution outlet for the Missouri Portland Cement Co., St. Louis, Mo., with the establishment of a cement terminal to serve the construction industry in Tennessee, Arkansas, Mississippi and other nearby southern States accessible by rail out of Memphis.

The terminal is located on the Wolf river, tributary to the Mississippi, which is a protected still-water harbor, and its source of supply, via Mississippi river by self-unloading barges, is Missouri's Prospect Hill plant located on the river just north of St. Louis.

A large capacity pack house, silo storage for 90,000 bbl. of portland cement and a dock were constructed at Memphis; specially designed steel barges were built for transport; and dock facilities were provided at the Prospect Hill mill, to complete a distribution setup that has greatly expanded market outlets into areas of great potential volume of construction. Shipments out of the Memphis terminal began March 18, 1947.

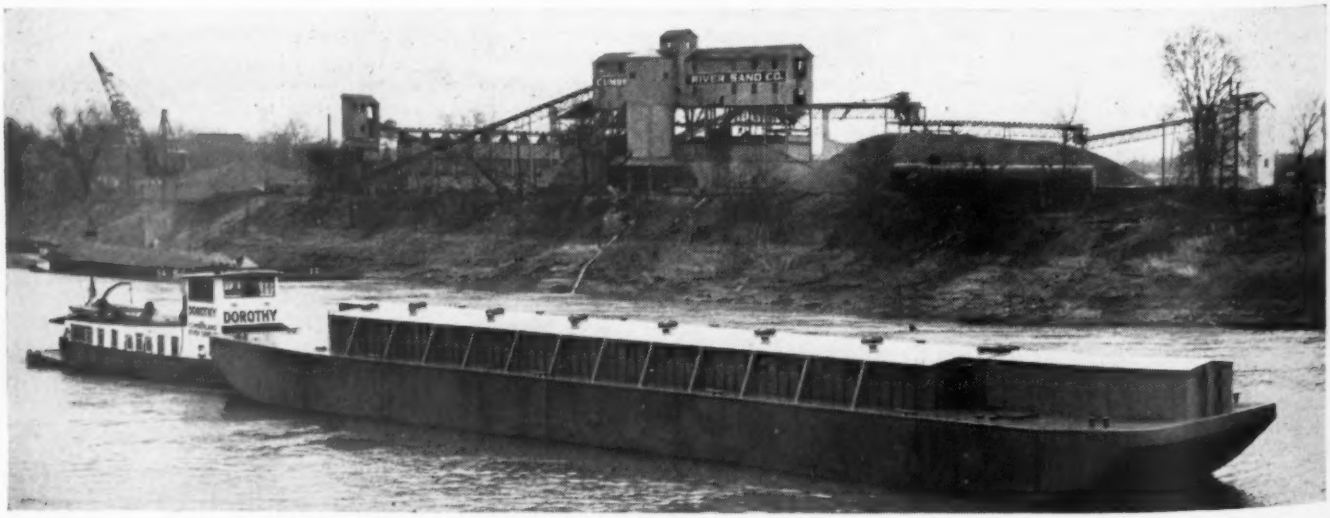
Loading facilities at St. Louis, transport, the dock facilities at Memphis, and operation of the packing plant will be considered herein in that order.

Loading Facilities

Docks at point of dispatch, and at destination, are of concrete and steel construction, using cement pump and pipelines exceeding 1000 ft. in length for delivery of cement, and were designed to anticipate Mississippi river flood conditions exceeding the stages of late June and early July which spread devastation and broke records that had stood more than 100 years. High water records and mean low water levels were thoroughly considered in designing docks to prevent interruption of operations even when the Mississippi is making newspaper headlines.

Manufacturing mills No. 1 and No. 2, at Prospect Hill, are located on the "Chain of Rocks" section of the river, a stretch downstream from the bridge of that name which has hard rock bottom. The four piers, including that supporting the end of a 2-span steel truss bridge, are anchored in bed rock, with the bridge spanning some 340 ft. overall out to the navigable channel. Pumping distance into barges is 1370 ft. through a 10-in. pipeline carried over the bridge, from a relay pumping station.

The pump is an 8-in. Fuller-Kinyon which delivers cement into barges through a 10-in. line at the rate of 400 bbl. per hour. Compressed air for pump operation is supplied by a duplex Fuller rotary air compressor rated at 2800 c.f.m. at 40 p.s.i. pressure.



One of seven new 195-ft. self-unloading barges opposite Nashville where it was manufactured

Seven all-steel self-unloading barges were designed and built to company specifications by the Nashville Bridge Co., employing Fuller-Kinyon 8-in. pumps and 1½-cu. yd. Sauerman Crescent scrapers for unloading. Designed for a conservative capacity of 8000 bbl. of standard portland cement each, the barges measure 195 ft. in length, 35-ft. beam, and have a draft of 9 ft. when fully loaded. Draft is the measure of load, which conforms with the approximate 9000 bbl. capacity of a single silo at Memphis.

Cement is loaded into the cargo hold through six loading hatches, which uniformly distribute load, making capacity shipments readily attainable.

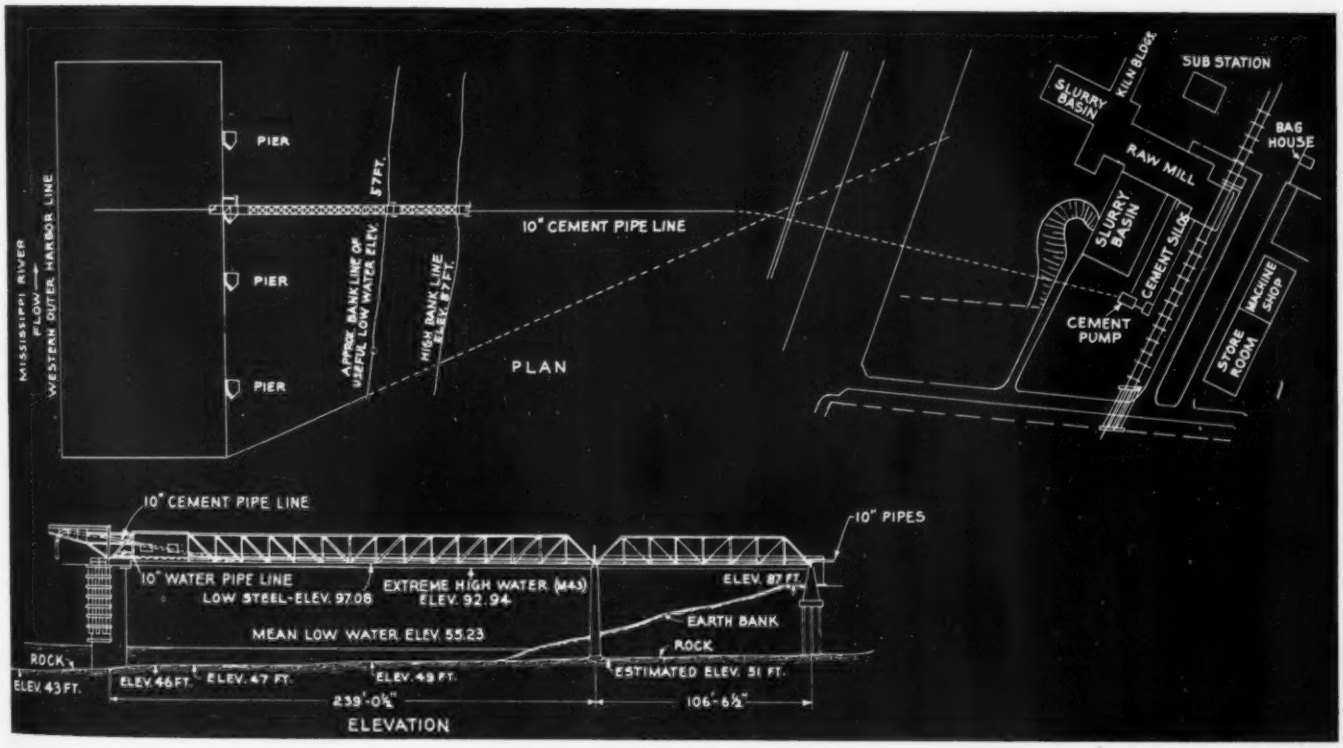
The hold has a hoppered bottom tapering to a 6-ft. trough, thus providing a single straight-line path for the scraper travel for the entire length of the cargo hold. During unloading, the scraper brings the cement up a ramp into the pump feed hopper.

An overhead trolley on a monorail extending the length of the hold and holding the tail block, may be positioned at any point whch is usually just beyond the edge of the remaining load. Power for scraper operation is supplied through a 3-drum, roller-bearing Sauerman hoist (60-hp. motor) located at the head of the ramp where the operator has full view of the hold from his cab. Travel speed is 200 f.p.m., loaded, and the rate of outhaul is 400 f.p.m., the third drum serving to control the travel of the overhead trolley. Unloading capacity is 350 bbl. of cement per hour through an 8-in. line a distance of 1000 ft., into the silos at Memphis. Marquette Transportation Co. has the contract for the barge tow and two or three barges are delivered at a time to the Memphis dock. Travel time is 8 or 9 days per round trip of some 1000 miles.

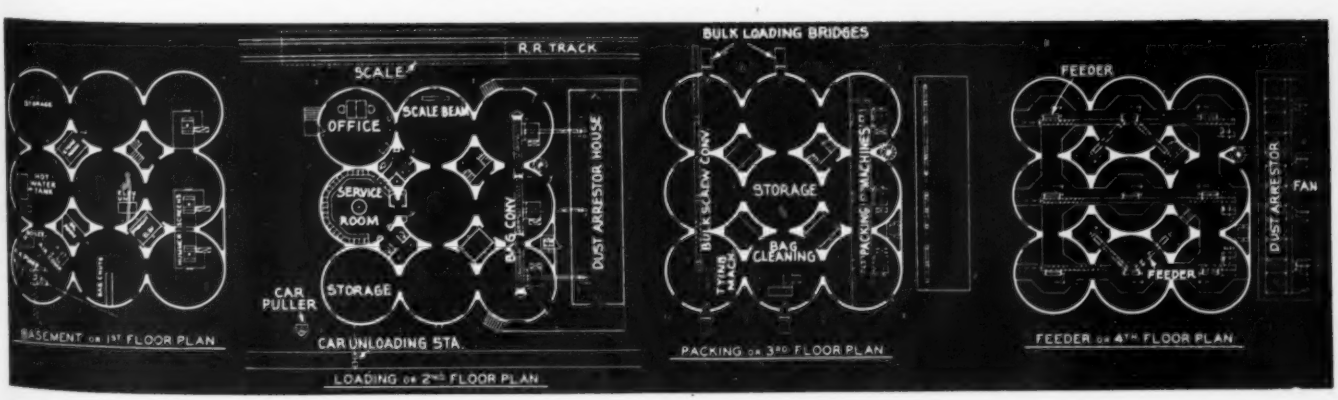
Unloading Operations

At the Memphis terminal, the dock also consists of a two-span bridge extending out into the Wolf river at a location not far distant from its junction with the Mississippi, providing means of support for pipelines, power cables, fuel line and a walkway from the high bank to the river pier. A water level two feet in excess of the highest known river level was anticipated in the design, the pier having stairways and five landings at 9-ft. intervals provided for ready access at any river stage to a captive barge tied to the pier.

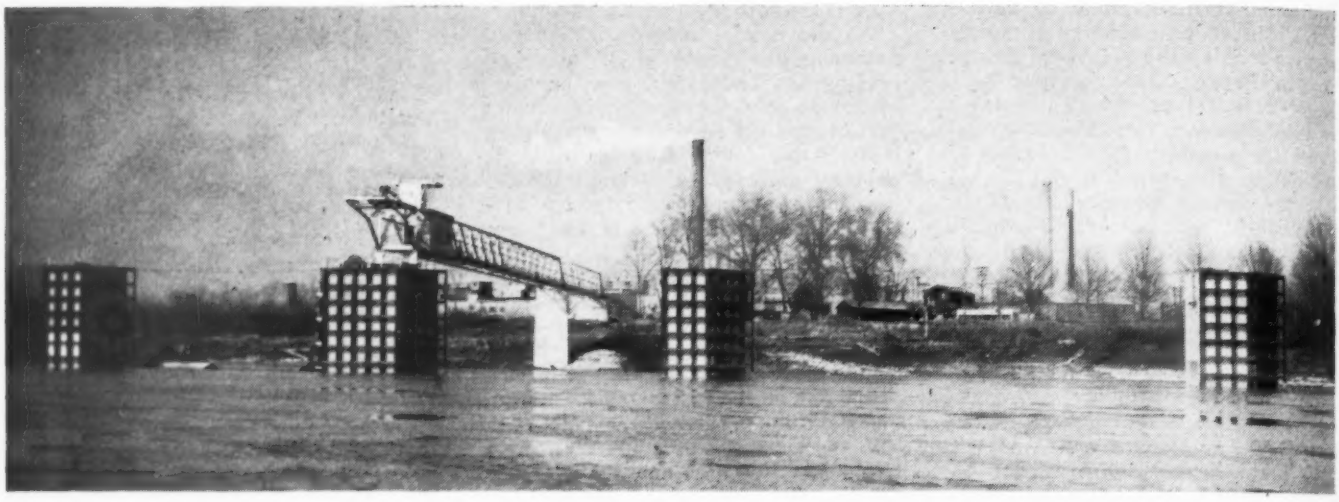
The captive barge is tied to its piers by sling-type connections so that it rises and falls with river level fluctuations, as a unit, with the loaded barges which are tied to it. On board the captive barge are the starting apparatus, electrical panel board and air compressor equipment required for



Plan and elevation details of St. Louis loading facilities



Showing arrangement of cement storage bins at Memphis and location of packing facilities, dust arrestor, and other equipment on the four floor levels



Dock facilities at St. Louis consist of 2-span bridge out to navigable channel and tie-up piers. Stacks rise from Mills 2 and 1, respectively

unloading barges and pumping cement into the cement terminal silos. Compressed air is developed by a Fuller rotary air compressor, rated at 1600 c.f.m. at 30 p.s.i. pressure, driven through V-belt by dual Cummins Diesel engines that develop 180 hp. The engines are identical to those used in trucks, cranes and locomotives operated by the company. Eight inch flexible rubber hose pipes, compressed air through fittings on the barge decks into the Fuller-Kinyon pump in the hold of each barge, and a similar hose transfers the cement into the 1000-ft. steel and cast iron pipeline to the plant.

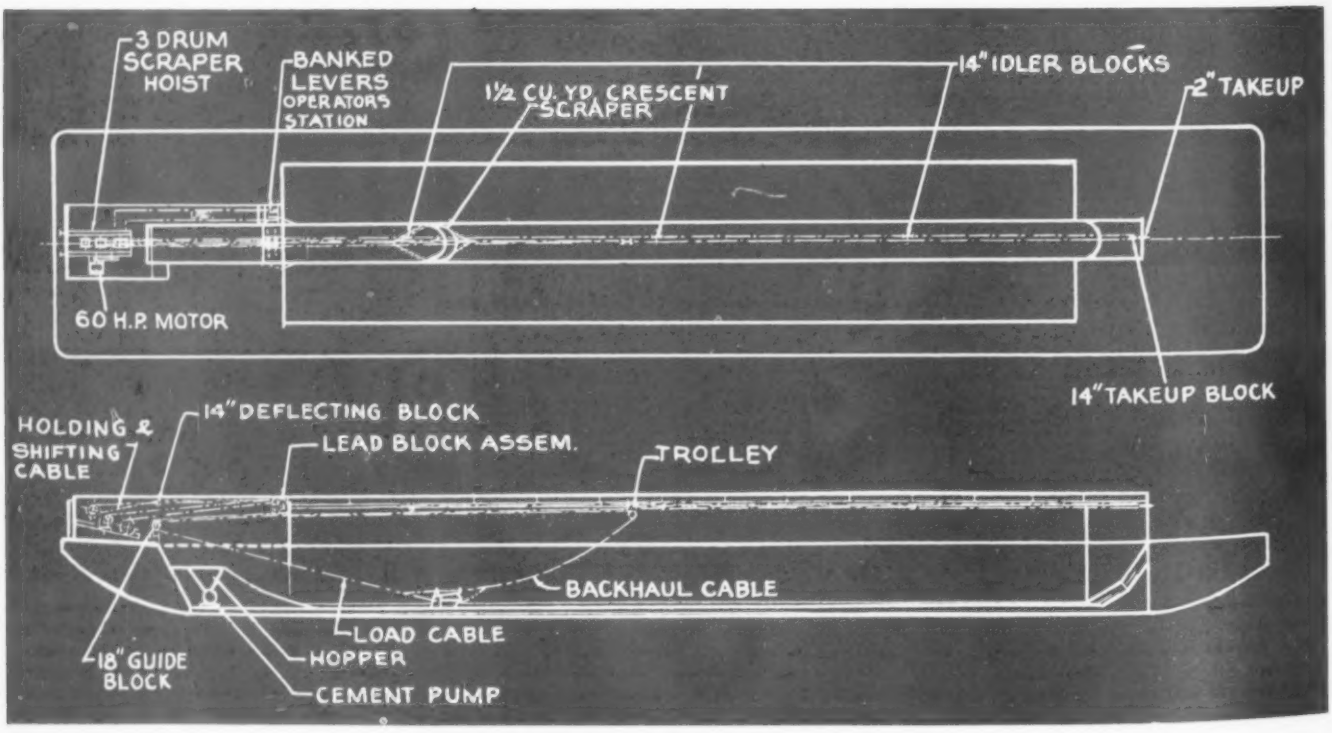
Flexible conductors for the power circuits are run from the panel control board to the respective barges where push buttons have been provided for operation of the various electrically-powered equipment.

Unloading is accomplished through an 8-in. steel pipeline which is cable-suspended from the pier and bridge. The pipe end, at its junction with the flexible hose at the barge, is hung from a chain hoist, and rides over a roller on a vertical monorail at the pier-end of the bridge for adjustment of position with rise and fall of the river level. Accessory equipment comprises: a Fairbanks-Pomona pump on board the captive barge for water supply, power lines, fuel line from a shore tank installation, and Link-Belt barge spotters to secure the barges. A Buffalo exhauster on the deck of the captive barge is connected through flexible air duct to ports on the side of each barge hull to draw out dust from the hold. Telephone service between the terminal plant and the captive barge is the means of communication.

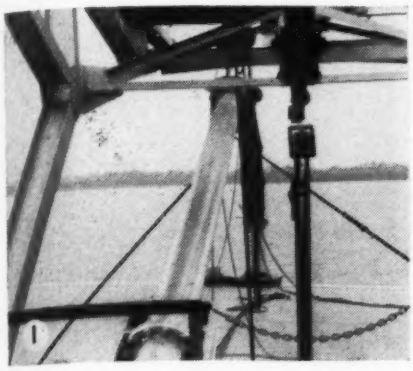
Cement Terminal

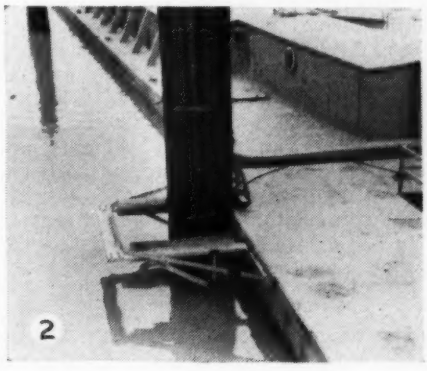
Location of the cement terminal is ideal from the standpoint of a versatile distribution center, the property being served by water, the Illinois Central railroad, and the Missouri Pacific railroad.

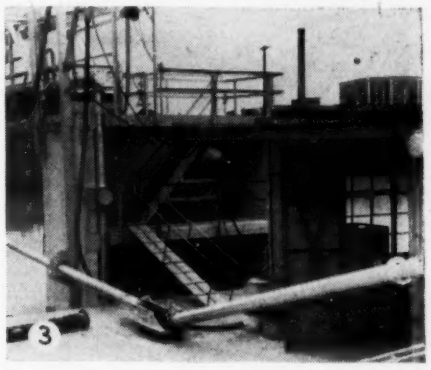
Operations comprise the storage of cement in silos and interstice bins, packing and shipping, the handling and storage of paper bags and the cleaning, mending and tying of returned cloth sacks. Cement may be received by rail as well as waterway, a 7-in. Fuller-Kinyon pump being provided for the purpose on the lower

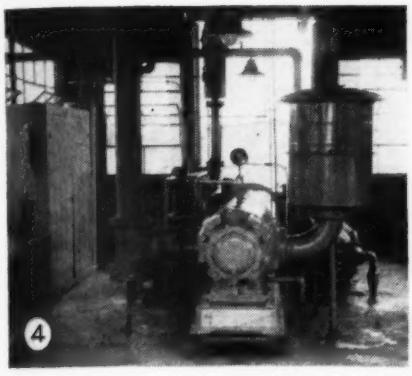


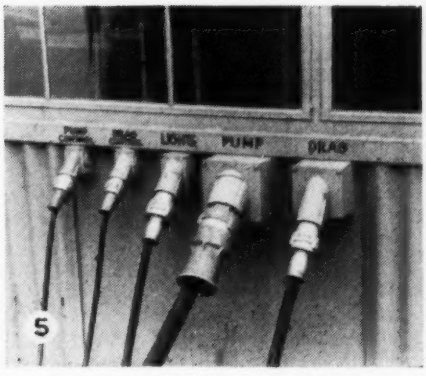
Plan and elevation details of cement carrying barge

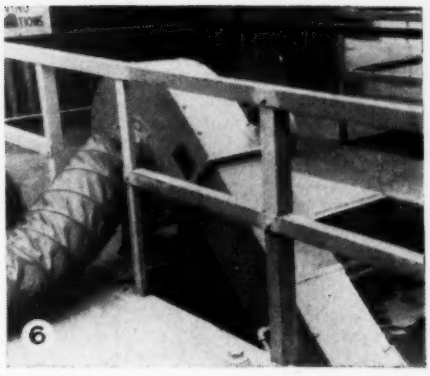


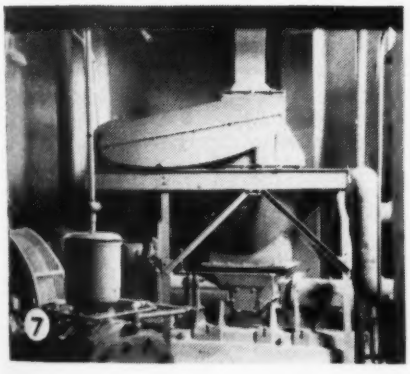


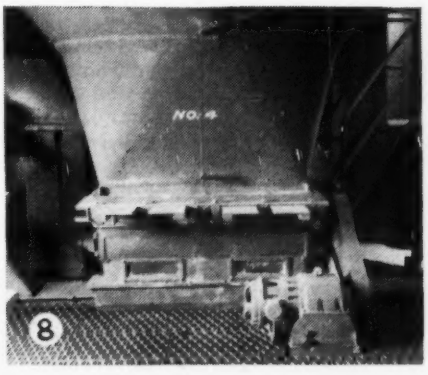


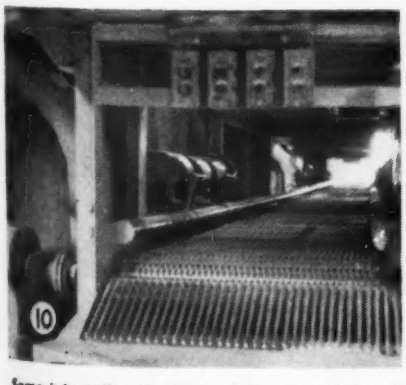


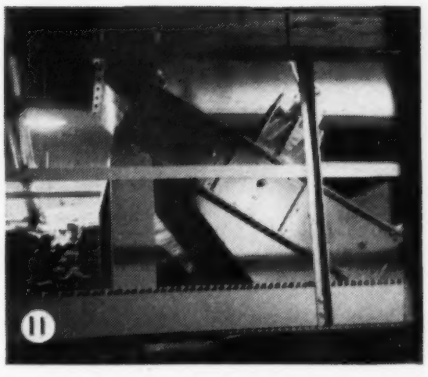


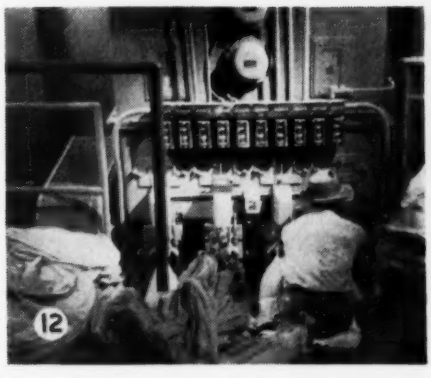




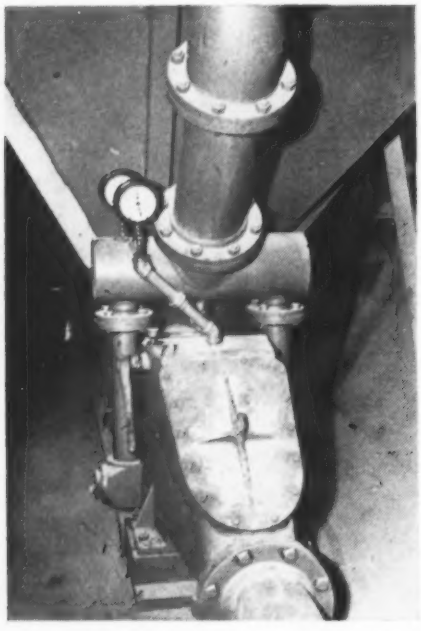








Some interesting features of barges and terminals. Fig. 1: End of cement pipe connection on loading barge at St. Louis. Fig. 2: Tying arrangement of captive barge permitting rise and fall with river level. Fig. 3: Captive unloading barge showing cement pipe line riding on rollers and supported on vertical monorail to compensate for river stage changes. There are five stairway levels to work from on pier. Fig. 4: Diesel-driven rotary air compressor on captive barge. Fig. 5: Electrical plug-ins on captive barge. Fig. 6: Dust exhauster hooked up to unloading barge. Fig. 7: Pump for interchanging cement between silos or for handling rail shipments. Fig. 8: Close-up of rotary valve on hopper-bottomed silo for complete clean-out. Fig. 9: Air cleaner for cloth sacks, Foreman Harper demonstrating operation. Fig. 10: Three reversible wire mesh conveyors for handling sacked cement. Fig. 11: One of vibrating screens to screen out extraneous material ahead of packing machine bin. Fig. 12: Close-up of packing machine. Note controls available to operator and bin level indicators to maintain constant head on bin



One of the cement pump installations on board self-unloading barges

Main trunk valve atop silos for cement distribution

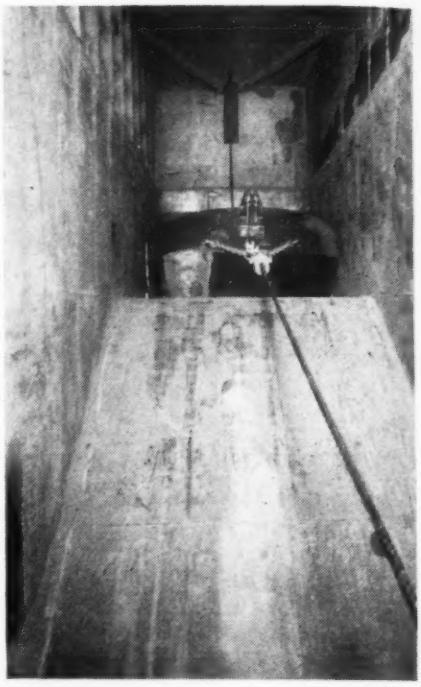
Dust collector installation at Memphis terminal showing connection to packing floor

level, the air supply line coming over the bridge from the captive barge, and the packing plant arrangement has been designed especially to prevent contamination of cements. Standard portland, high-early-strength, air-entraining and mortar cements are available out of the terminal. All deliveries are by rail and the bulk of the shipments are of packaged cement in box cars.

Plant Layout

The plant structure consists of nine reinforced concrete silos with a storage capacity of 9000 bbl. of portland cement each, with four interstices, having a total storage capacity of 90,000 bbl. Overall height of the structure is 131 ft., of which 85 ft. is silo storage and 46 ft. comprises four operating floor levels.

As shown in the accompanying plan layouts, the fourth floor is the feeder floor where cement is drawn from the silos into screw conveyors for transport to the packing machines. The third level, or packing floor, houses three packing machines, the main bulk loading screw conveyor, and tying machine, and provides for bag storage and cleaning in various bays. On the second level, the loading floor, are located the bag conveyors, the office, Howe scale beam for weighing bulk cement cars, additional bag storage and separate locker rooms and tiled showers for white and colored employes. In the basement, on the first level, are the heating plant, hot water heater, oil room, store room, a Gardner-Denver air compressor for bin aeration, three vibrating screens operated in conjunction with the packing machines, and the 7-in. Fuller-Kinyon pump which is used to transfer cement between the several silos or for filling silos with cement received by



Showing how scraper draws cement up ramp into hopper feeding cement pump

rail. Bags are received by box cars at the lower level through a chute. Bags and other supplies are handled by hand-propelled 4-wheel platform trucks, and a 3000-lb. Rotary Lift freight elevator has been provided for repair purposes and to elevate bags to the packing floor. Transportation to the roof for purposes of inventory, inspection or valve changes is by Shepard electric elevator.

A Fuller main trunk valve and a system of laterals with Hamerline blinds to the separate silos on the roof, are the means of directing flow of cement into storage. Steel conical bottoms on each silo, each equipped

Captive barge at Memphis terminal. Cement discharge line is on left and air inlet from compressor is directed into barge to pump. Note levels and stairs on pier, extreme left, to provide for various river levels

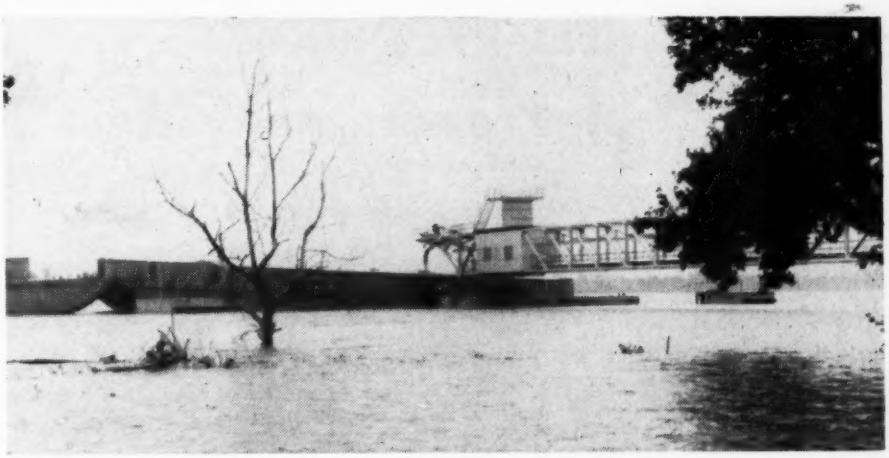
with a St. Regis rotary feeder, enable complete emptying of a silo, and the arrangement is such that cement is conveyed by screw conveyors directly into the packing machine bins without elevation.

Three Modern 4-tube packing machines, of 300 bbl. per hour capacity each, are so installed that they are served by independent equipment in order to prevent contamination. A collecting screw conveyor under the row of three silos paralleling the I. C. railroad tracks is the means of transfer of cement from those silos to one packing machine bin. St. Regis rotary feeders and feeder screws to the collecting screw transfer cement from the two adjoining interstice bins to the same screw filling the packing machine bin. Similarly, cement is handled on the opposite side, to the third packing machine bin, while the second machine is fed from the middle row of three silos. Constant head is maintained on the packing machines by high- and low-level Bin-dicators on each packing machine bin which automatically start and stop the feed out from a given silo to the screw conveyor filling the bin. The three parallel screw conveyors filling the packing machine bins are reversible so that cement from any silo, or combination of silos, can be conveyed in the opposite direction into a large cross direction screw conveyor. The latter conveyor is also reversible for transfer in one direction into a bulk cement flexible car-loading spout or, in the other direction, to supply the 7-in. Fuller-Kinyon pump when it is desired to empty one silo into another. Normal procedure, in loading bulk cement, is to open a rotary valve in the conical bottom of any of the six silos adjacent to the tracks to release cement directly into cars by gravity through flexible spouts.

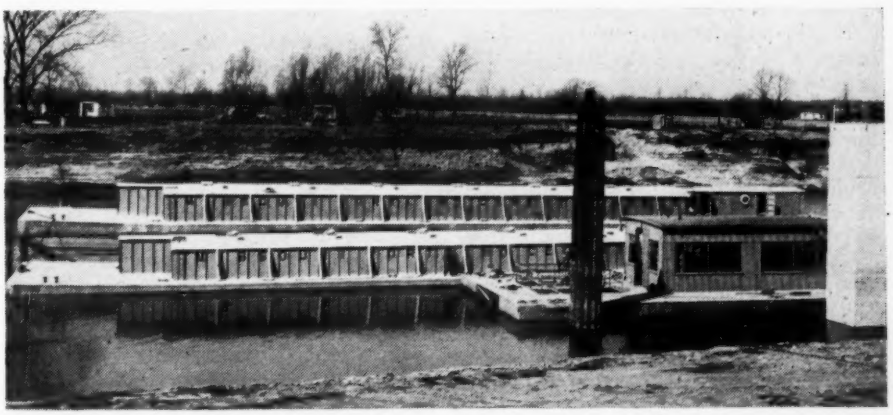
Each packing unit (3) is connected to a separate unit of a Sly 2-unit automatic-type envelope dust arrestor. Dust and spill from around the packing tubes and woven wire bag conveyor are collected and discharged, by automatic rapping in the arrestor, into separate (3) 9-in. screw conveyors for return into the separate packing machine bins. This dust and the cleanup spill around the floor, which enters each screw conveyor through floor openings and spouts provided for the purpose, are put over separate (3) 5- x 5-ft. Tyler Hum-mer vibrating screens and then re-conveyed and elevated into the packing machine bins. A suction pipe cleaner connected to the fourth unit of the dust arrestor is used to clean cloth bags. Sorting is done simultaneously with the cleaning operation and, if mending is not required, the sacks are diverted directly to a St. Regis automatic tying machine.

Each packing machine operator has

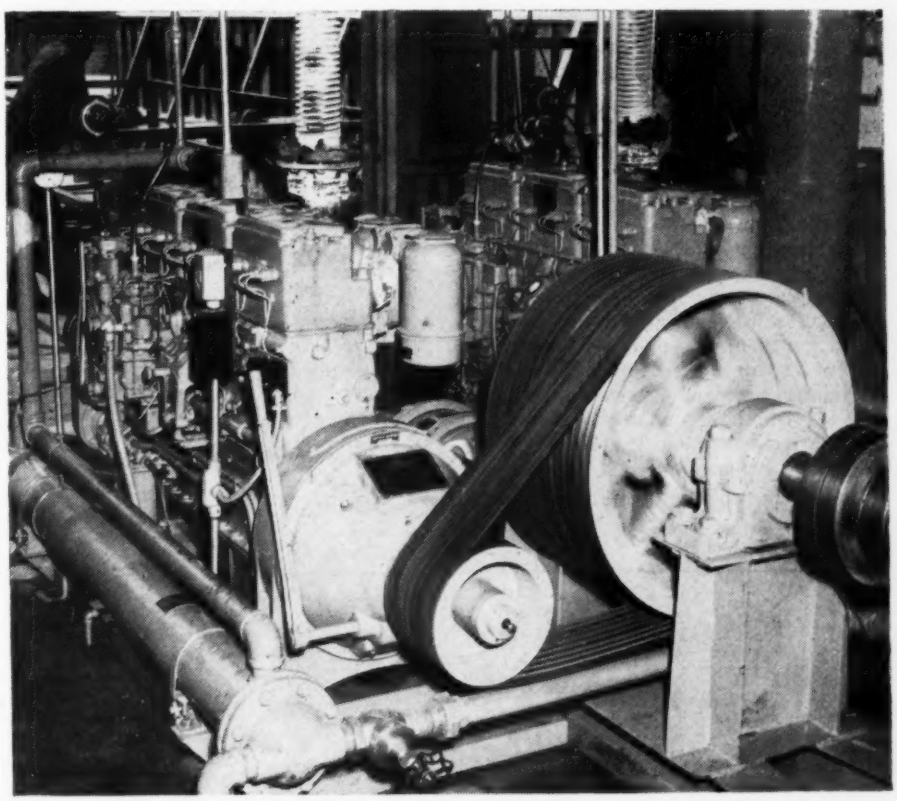
(Continued on page 171)



Loading bridge at St. Louis with Mississippi river in flood stage



Self-unloading barges tied up to captive barge at Memphis during low-water period



Close-up of dual drive by Diesel engines of rotary air compressor on Memphis captive barge

Mathematical Problems of Proportioning Raw Materials

By RALPH W. HUBBS

PROPORTIONING of raw materials in the manufacture of portland cement is a continuous operation in which large quantities of rock must be handled rapidly to insure a steady flow of materials for the raw-mills grinding operation and the correct mix for the clinkering process in the kilns. At some dry plants the proportioning is done in a single operation; while others use a two-stage method, the rock first being proportioned into batch bins of uniform tonnages, then corrected, if necessary, while being transferred to the mill feed bins.

Some of the mathematical problems common to one or both methods will consist of the following:

1. Calculations involved in computing the percentages of each raw material to be used in the preliminary proportioning. This will be the same in each method, but must be more accurate in the single proportioning.

2. Calculations to obtain the amount of limestone or shale needed to lower or raise the carbonates or "silicates" in a batch of proportioned rock. The carbonates or "silicates" are quick tests used for control purposes. They are made on the representative samples taken from each batch of proportioned rock.

3. The problems of correcting a batch of rock when the chemical analysis, instead of quick tests, has been made.

In order to compute the percentages of raw materials needed for the proportioning of the required mix, it is necessary to have the analysis of each material and its calculated compound compositions which will be used as controlling points, usually the C_3S and C_3A. The method used should be as simple as possible, to insure accuracy and speed of operation; for the time element is an all-important factor of the control operations. The following problem was worked by a method which has proved sufficiently flexible and reliable to be used in everyday control.

From the chemical analysis of the following raw materials calculate a mix which will have a C_3S between 55 and 60 and a C_3A between 6.0 and 6.5.

I. CHEMICAL ANALYSIS OF RAW MATERIALS

	Limestone		Shale		Iron Ore	
	Unignited	Ignited	Unignited	Ignited	Unignited	Ignited
SiO_2	4.53	7.77	46.40	54.85	11.14	11.80
Al_2O_3	0.35	0.60	13.68	16.17	2.58	2.73
Fe_2O_3	0.16	0.27	5.00	5.91	77.33	81.91
CaO	51.37	88.11	16.60	19.62	1.90	2.01
MgO	1.56	2.68	2.92	3.45	1.46	1.55
Loss	41.70		15.40		5.59	
100-loss	58.30		84.60		94.41	
Compound Compositions						
C_3S	295	—	—454		—217	
C_3A	1.2		32.9		—131	

II. Proportioning the limestone and shale to a 60 C_3S content. Limestone C_3S = 295, shale C_3S = —454.

(a)

$$60 - (-454) = 514 \text{ parts limestone.}$$

$$295 - 60 = \frac{235 \text{ parts shale.}}{749 \text{ total parts.}}$$

The desired 60 C_3S minus the shale C_3S will give the fractional parts of limestone, and the limestone C_3S minus the desired 60 will give the fractional parts of shale needed in the proportioning.

(b) To change the fractional parts to ignited percentage basis it is only necessary to divide each figure by the total parts.

$$\frac{514}{749} = .6862 = 68.62\% \text{ limestone.}$$

$$\frac{235}{749} = .3138 = 31.38\% \text{ shale.}$$

(c) To change from ignited to unignited, or raw material basis, the ignited figure is divided by 100 — loss/100 for each material; then each quotient is divided by the sum of the two quotients.

$$\text{Limestone loss} = 41.70\frac{100 - 41.70}{100} = .5830$$

$$\text{Shale Loss} = 15.40\frac{100 - 15.40}{100} = .8460$$

$$\frac{.6862}{.5830} = 1.177 \quad \frac{1.177}{1.548} = .7603 = 76.03\% \text{ limestone.}$$

$$\frac{.3138}{.8460} = 0.371 \quad \frac{0.371}{1.548} = .2397 = 23.97\% \text{ shale.}$$

Total = 1.548

Thus 76.03 per cent limestone and 23.97 per cent shale will give a 60 C_3S mix.

In actual control it is not necessary to work out this analysis of proportioned parts, for the results can be obtained by merely taking the ignited percentages of each material's C_3S and C_3A.

	76.03% Limestone	23.97% Shale	Total Unignited	Ignited
SiO_2	3.44	11.12	14.56	22.54
Al_2O_3	0.27	3.28	3.55	5.49
Fe_2O_3	0.12	1.20	1.32	2.04
CaO	39.06	3.98	43.04	66.62
MgO	1.19	0.70	1.89	2.93
Loss	31.70	3.69	35.39	
100 — loss			64.61	
Compound Compositions				
C_3S				60.0
C_3A				11.1

68.62% of 295 C_3S = .6862 × 295 = 202

31.38% of —454 C_3S = .3138 × —454 = —142

100% = 60 C_3S

68.62% of 1.2 C_3A = .6862 × 1.2 = 0.82

31.38% of 32.9 C_3A = .3138 × 32.9 = 10.32

100% = 11.14 C_3A

III. To correct the C_3A from 11.1 to 6.5 by proportioning the 76.03 per cent limestone and 23.97 per cent shale with iron ore having a —131 C_3A.

(a)

$$6.5 - (-131) = 137.5 \text{ parts of the first mix.}$$

$$11.1 - 6.5 = \frac{4.6 \text{ parts of iron}}{142.1 \text{ total parts.}}$$

(b)

$$\frac{137.5}{142.1} = .9676 =$$

96.76% of the first mix, ignited basis.

$$\frac{4.6}{142.1} = .0324 =$$

3.24% iron ore, ignited basis.

(c)

96.76% of the first mix 60 C_3S = 58.0
3.24% of iron ore —217 C_3S = —7.0

100% second mix = 51.0 C_3S

96.76% of the first mix 11.1 C_3A = 10.74
3.24% of iron ore —131 C_3A = —4.24

100% second mix = 6.50 C_3A.

(d) To change to unignited basis: If the first mix complete analysis was not worked out it will be necessary to compute the total loss for that mix so that the 100 — loss/100 figure may be obtained.

First mix loss = 35.39 100 — loss/100 = .6461
Iron ore loss = 5.59 100 — loss/100 = .9441.

$\frac{.9676}{.6461} = 1.4976$ $\frac{1.4976}{1.5319} = .9776 =$ 97.76% of first mix.

$\frac{.0324}{.9441} = 0.0343$ $\frac{0.0343}{1.5319} = .0224 =$ 2.24% iron ore.

Total = 1.5319

(e) To get the actual percentages of limestone and shale used in the second mix.

97.76% of 76.03 = 74.33% Limestone.
97.76% of 23.97 = 23.43% Shale.
2.24% Iron ore.

Total = 100.00% second mix.

Thus 74.33 per cent limestone, 23.43 per cent shale, and 2.24 per cent iron ore will make a mix of 51.0 C_3S and 6.5 C_3A.

IV. As the C_3S is now too low, it will be necessary to cut the amount of shale and increase the percentage of limestone. The limestone C_3S is 295 and the shale C_3S is —454. For each 0.1 per cent addition of limestone the C_3S will be raised approximately 0.295 and for each 0.1 per cent decrease in shale the C_3S of the mix is increased 0.454, a total of 0.75. An increase of 0.5 per cent limestone and a 0.5 per cent decrease in shale should give a C_3S of 55. The actual amount as calculated is 55.8. An increase of 1.0 per cent limestone with a 1.0 per cent decrease in shale should give a mix near 59.0 C_3S.

	75.33% Limestone	22.43% Shale	2.24% Iron Ore	Total Unignited	Ignited
SiO_2	3.41	10.41	0.25	14.07	21.64
Al_2O_3	0.26	3.07	0.06	3.39	5.21
Fe_2O_3	0.12	1.12	1.73	2.97	4.57
CaO	38.70	3.72	0.04	42.46	65.31
MgO	1.18	0.65	0.03	1.86	2.86
Loss	31.41	3.45	0.13	34.99	
100 — loss				65.01	
Compound Compositions					
C_3S					59.8
C_3A					6.1

Thus 75.33 per cent limestone, 22.43 per cent shale, and 2.24 per cent iron ore are the required percentages of the raw materials necessary to proportion a mix of 59.8 C_3S and 6.1 C_3A.

When a plant uses the two-stage system the rock may be proportioned into batch bins and quick "silicate" tests made of the composite samples of each bin. If these bins are lower or higher than the "silicate" figure desired, it is necessary to correct the rock while it is being transferred to the mill feed bins. The equations for the calculations are as follows:

To correct a high "silicate" bin with low "silicate" rock (limestone) to a desired "silicate" content.

$$X = \frac{(\text{High "silicates"} - \text{Desired "silicates"}) \times \text{Weight of bin.}}{\text{Desired "silicates"} - \text{Low "silicates."}}$$

X = Weight of low "silicate" rock needed.

Problem: To correct a 22.0 per cent batch to 20.0 per cent "silicates" with a 7.0 per cent "silicate" rock. Weight of batch is 220 tons.

$$X = \frac{(22 - 20) \times 220}{20 - 7} = \frac{2 \times 220}{13} = 33.8 \text{ tons.}$$

Thus 33.8 tons of limestone is needed to correct 220 tons of 22.0 per cent "silicate" rock to give 20.0 per cent "silicates."

To correct a low "silicate" bin with shale to raise "silicates" to a desired figure.

$$X = \frac{(\text{Desired "silicates"} - \text{Low "silicates"}) \times \text{Weight of bin.}}{\text{Shale "silicates"} - \text{Desired "silicates."}}$$

X = Weight of shale needed.

Problem: To correct an 18.0 per cent "silicate" bin to 20.0 per cent with a 90.0 per cent "silicate" shale. Weight of bin is 220 tons.

$$X = \frac{(20 - 18) \times 220}{90 - 20} = \frac{2 \times 220}{70} = 6.29 \text{ tons.}$$

Thus 6.29 tons of shale are needed to raise an 18.0 per cent "silicate" bin to 20.0 per cent "silicates."

There are occasions when it may be necessary to make a chemical analysis of proportioned bins and, if necessary, to correct them to the desired C_3S and C_3A content. The calculations are quite similar to those of the preliminary proportioning.

In this problem the proportioned bin is 71.0 C_3S and 8.0 C_3A. It is desired to calculate the amount of shale and iron ore needed to correct the bin to a C_3S between 45 and 50 and a C_3A between 5.8 and 6.2. (Table II below)

II. Proportioning the bin and shale to lower C_3S to the 45-50 range.

(a)

50 — (—594) = 644 parts bin.
71 — 50 = 21 parts shale.

665 parts total.

(b) To change to percentages, ignited basis.

$\frac{644}{665} = .9684 =$ 96.84% of bin.

$\frac{21}{665} = .0316 =$ 3.16% shale.

Proof:

96.84% of 71 C_3S = 68.8
3.16% of —594 C_3S = —18.8

100% = 50.0 C_3S

The C_3A may be obtained the same way.

96.84% of 8.0 C_3A = 7.75
3.16% of 30.0 C_3A = 0.95

100% = 8.70 C_3A

(c) To change from ignited to unignited basis.

Bin loss $= 34.33 \frac{100 - 34.33}{100} = .6567$

Shale loss $= 7.30 \frac{100 - 7.30}{100} = .9270$

$\frac{.9684}{.6567} = 1.4746$ $\frac{1.4746}{1.5087} = .9774 =$ 97.74% of bin.

(Continued on page 178)

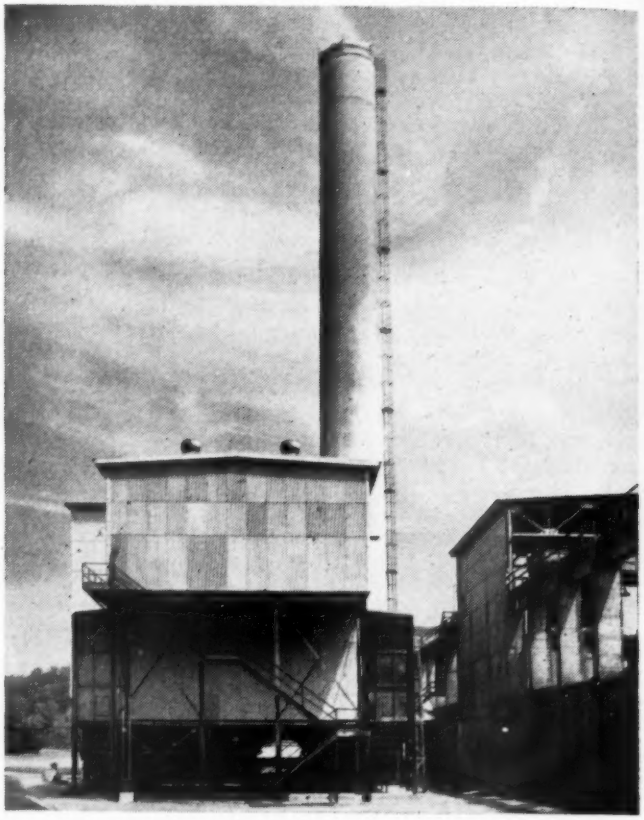
II. CHEMICAL ANALYSIS OF BIN AND RAW MATERIALS

	Bin		Shale		Iron Ore	
	Unignited	Ignited	Unignited	Ignited	Unignited	Ignited
SiO_2	14.03	21.36	62.71	67.65	9.40	9.86
Al_2O_3	3.19	4.86	14.29	15.42	2.38	2.50
Fe_2O_3	1.88	2.86	5.76	6.21	80.27	84.00
CaO	43.58	66.36	7.39	7.97	2.50	2.62
MgO	2.54	3.87	2.55	2.75	0.83	0.87
Loss	34.33		7.30		4.62	
100-loss	65.67		92.70		95.38	
Compound Compositions						
C_3S		71.0		—594.0		—200.0
C_3A		8.0		30.0		—136.0

High Efficiency In Stack Dust Recovery

Universal Atlas Cement Company installs new type precipitation unit at Leeds plant; large proportion of stack dust returned as kiln feed material

By BROR NORDBERG



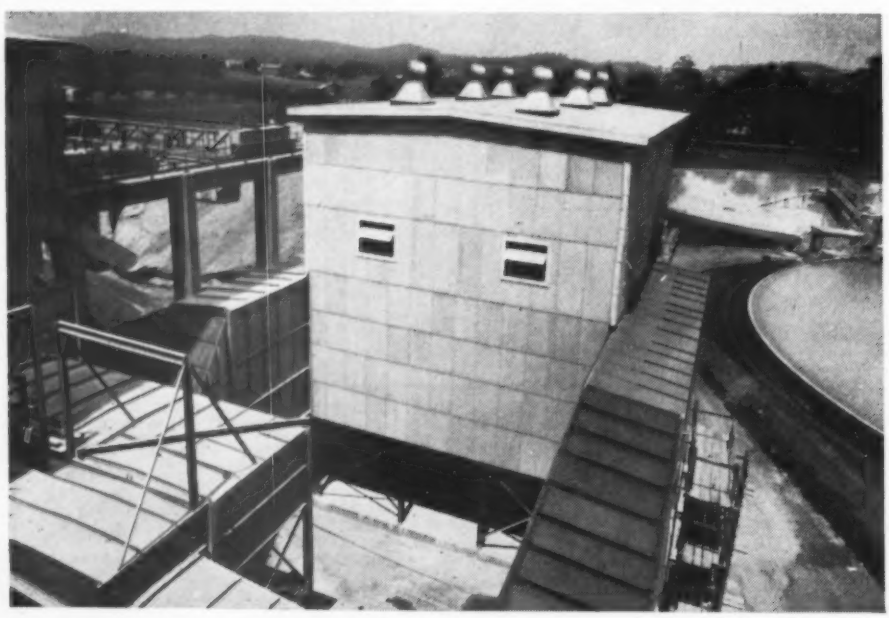
Dust collector (foreground). Inlet flue end left, outlet flue right, with substation above. Note only wisp of moisture coming from stack

DUST RECOVERY from stack gases at efficiencies in excess of 94 per cent is being achieved at the Leeds, Ala., mill of Universal Atlas Cement Co. since installation of dust collecting equipment completed in May, 1947.

When the Leeds plant was rebuilt into a wet process plant, in 1938, it was intended that the two newly-installed 10- x 300-ft. rotary kilns be operated on natural draft supplied through a 12½- x 200-ft. concrete stack with the proviso that induced draft be adopted in the event that lengthy heat exchanger chains later be installed. At that time capacity was calculated at 88 bbl. of portland cement clinker per kiln per hour.

Induced draft was soon adopted and the tempo of production has stepped up progressively to the point where the kilns now are averaging better than 2500 bbl. of clinker each. For the size of the kilns, that rate of production is outstanding. The kilns are driven at the extremely high speed of 100 r.p.h., carry the extraordinary draft of 1.5 in. of water between the kiln backhousing and the firing end hood and, as would be expected, are exhausting proportionately greater volume of dust along with the exit gases.

The original layout, for natural draft only, had no provision for stack dust collection other than that small fraction of the dust load that settled in the exhaust flues, which was recovered through hoppered-bottoms in the flue to collecting screw conveyors, elevated and fed back into the kilns with the slurry feed. Dust escaping through the stack then was not nearly the amount lost under forced draft, accelerated operation of recent date, which was a factor in the installation of dust recovery equipment.

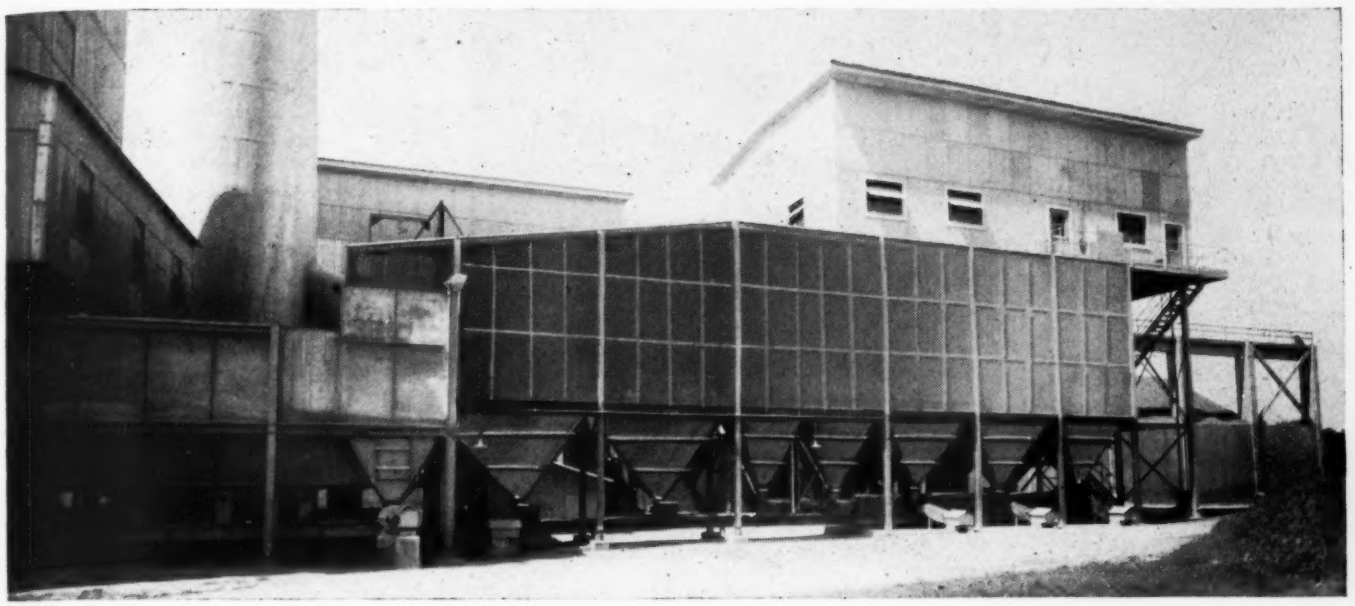


Electrical precipitator; inlet flue on right and return outlet flue, left, for gas return to stack

The Collector

The collector installed is designated as a Western Precipitation Corp. "rod curtain and pocket electrode" Cottrell electrical precipitator and is the first of its type to go into service in the portland cement industry. At Leeds, the installation is a three-unit collector, each consisting of two rod curtain electrode sections followed by a pocket electrode section, and with a total of nine discharge hoppers.

The feature new to the portland cement industry is the pocket electrode section which differs principally from the conventional rod curtain type in the design of the hanging electrodes. They are of V-shaped strips that hang vertically, with the apex of the V facing the direction of the gas stream passing horizontally through the collector. This design detail was perfected to trap particles of dust in pockets, so to speak, and was developed by the manufacturer during the war for other industrial applications demanding high efficiency in the collection of extremely fine dust fractions. Essentially the pocket electrode section at Leeds consists of 12 ducts, and 8 ft. x 18 ft. screens of double pocket electrodes, spaced 10 in. center-to-center, paralleling the di-



Inlet flue in foreground (7 hoppers), showing connection to existing flue. Substation is above, to the right

rection of gas flow. The two rod sections of each unit, comprising in effect primary and secondary collection sections, are the typical design for other Cottrell installations used in the portland cement industry. They have 15 ducts and comprise 8-ft. x 18-ft. rod curtains spaced 8 in., center-to-center, also paralleling the gas stream. Overall, a unit of three sections measures 37 ft. 6 in. in length, parelleling the direction of gas flow, and the width is 11 ft. 10 in. for each of the three units comprising the collector.

Essentially a single-stage Cottrell, the kiln exit gases are passed through an electrically-charged high potential field, and ionization and collection take place simultaneously. A mechanical rectifier provides the essential unidirectional current supply necessary to attract dust particles to the collecting electrodes, and transformers provide a range of secondary voltages between 50,000 and 75,000 volts. Rapping of the discharge electrodes is done mechanically and automatically by a compressed air-activated drive, synchronous motor-driven cams operating contactors which energize the solenoids of solenoid valves.

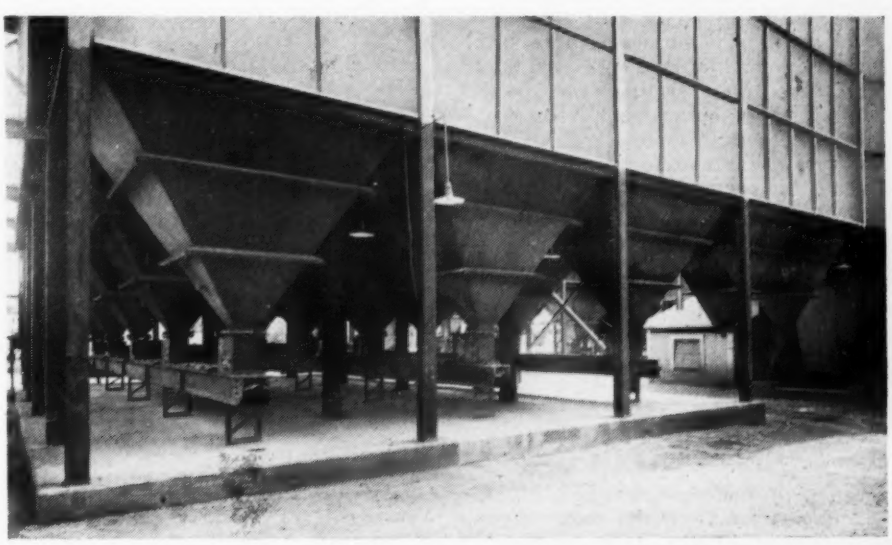
Arrangement and Operation of Collector

Installation of the Cottrell at Leeds was a comparatively simple project, consisting of an extension of the existing common flue, to form a seven pocket inlet flue paralleling the kilns beyond their feed ends, from which the gas stream divides at right angles to pass through the three units in parallel, emerging from the three pocket electrode sections into an outlet flue with three hoppers which parallels the inlet flue and returns the gases into the wind box of the induced draft fan at the base of the stack. Thus there are 19 discharge hoppers of which nine are outlets for dust rapped from the Cottrell. A small fraction of the total dust coming from the kilns settles in the pockets of the inlet flue and an almost negligible fraction settles in the outlet flue hoppers, which were provided mainly as a precaution against buildup over long time periods. Three parallel screw conveyors, one for each Cottrell unit, transport dust, as it is rapped down, into a single screw conveyor under the inlet flue which conveys the dust into the regular screw provided originally to feed an elevator which returns the dust to the kiln feed floor. All conveyors are 9-in. spirals.

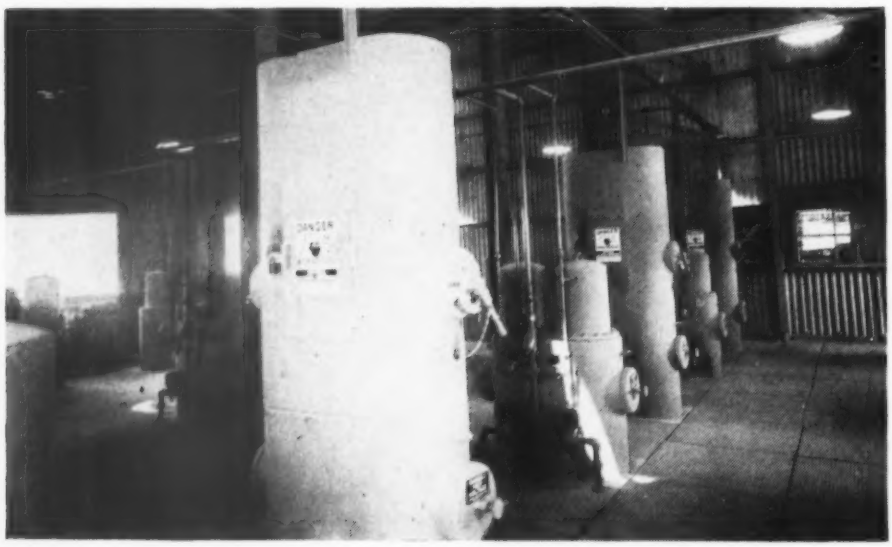
The Cottrell was designed to handle 300,000 c.f.m. of gases but, thusfar, has been operated at some 30,000 c.f.m. less due to limitations of the existing induced draft fan motor which will soon be replaced by one of larger capacity. When higher gas volume becomes available, a collection efficiency in excess of 94 per cent likely will still be attained, with a gas velocity of 6 ft. per second.

Hand-operated inlet dampers, which consist of a series of parallel movable plates actuated from the operating floor above, are available to regulate distribution of the gases to the respective three Cottrell units, but the principal purpose for which they are needed is in the event it becomes desirable or necessary temporarily to by-pass one of the collecting units. Similarly, there are hand damper controls for the outlet flue dampers, the combination enabling the operator to distribute the gas load as he desires. Electrically-operated motorized speed reducers operate the collector damper hoists for automatic closing and opening of dampers if desired in connection with the rapping cycle.

Due to the high volume of dust col-



Another view of collector hoppers with outlet flue in foreground



View above collector, showing insulated tops of electrodes

lected, a 30-minute rapping cycle has been adopted, the timing and sequence selected according to the carrying capacity of the several screw conveyors for dust disposal. Five minutes are required for the rapping cycle of a unit, started by selector on the electrical panel in the overhead substation, with five minute intervals between cycles to even out the load carried by the main collecting screw conveyor. Compressed air available in the plant at 90 p.s.i. is put through a reducing valve into an air receiver from which air at 70 p.s.i. is available for rapping. A receiver tank is used in the circuit to minimize surges in the plant compressed air system.

The Cottrell is operated at a voltage of 55,000, stepped up by transformer from the 440-volt line potential, automatic selection of transformer leads to change the high potential being available at the substation panel board. The transformers are interchangeable in pairs or singly for the various collector sections.

Flue gases carry a temperature of 800 deg. F. at the kiln outlet and approximately 30 per cent moisture which is considered nearly ideal for optimum ionization and collection, and the Cottrell was designed for operation at a maximum temperature of 700 deg. F. Small amounts of air are bled into the intake flue when needed, to hold temperatures within a range of 600-630 deg. F. as measured by thermocouple in the outlet flue from the Cottrell. Temperature drop through the intake flue and Cottrell, due to radiation, is approximately 150 deg. F. Automatic regulation of the air inlet dampers is to be installed. Draft drop across the collector is 0.3 to 0.5 in. of water.

Operating Data

Under present operating conditions, escaping vapor from the stack is the only outward evidence of operation when the plant is in full production. Of the total dust recovered, only 55 per cent is now returned into the kilns. The amount returned is limited by the present method of feeding the dust. Plans are being made to return all dust collected to the kilns.

Quantitative tests conducted to determine the recovery of dust indicate that 49.2 per cent is recovered in the first rod curtain sections (3) of the Cottrell, 30.8 per cent in the second rod sections and 20 per cent in the pocket electrode sections. According to particle size, the recovery is 5.8 per cent residue on the 200-mesh sieve for the dust recovered in the first rod sections, 9.7 per cent plus 200-mesh for the second rod sections and 15.8 per cent retained on that sieve for the dust recovered in the pocket electrode sections. Hourly samples expressed in lbs. recovery indicate uniform distribution and performance through the three sections of the three units.

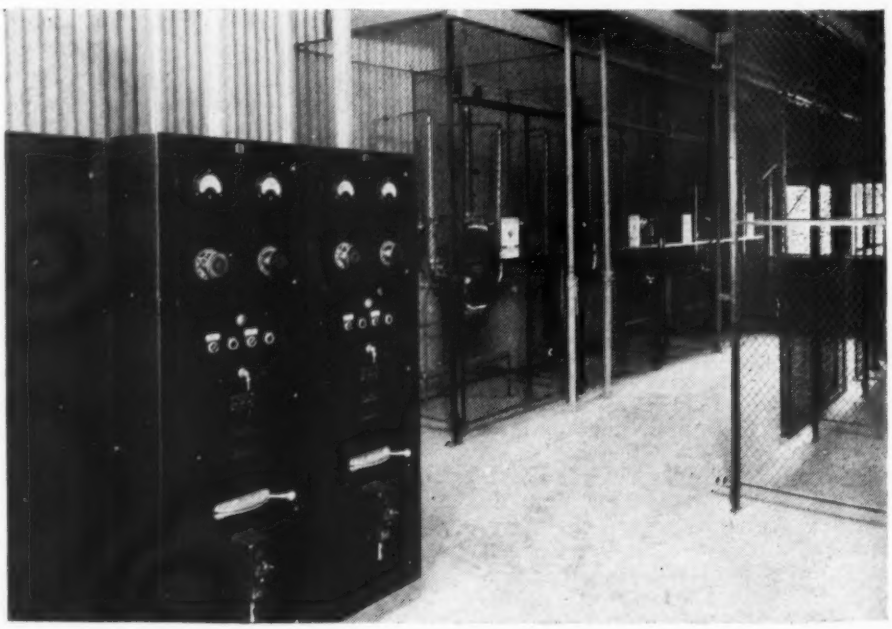
The Cottrell consumes 75 k.w. of electrical power including that required to drive the ventilating fan in the substation. Total power required for the installation, including screw conveyors and lighting is 95 k.w.

Returning Dust into Kilns

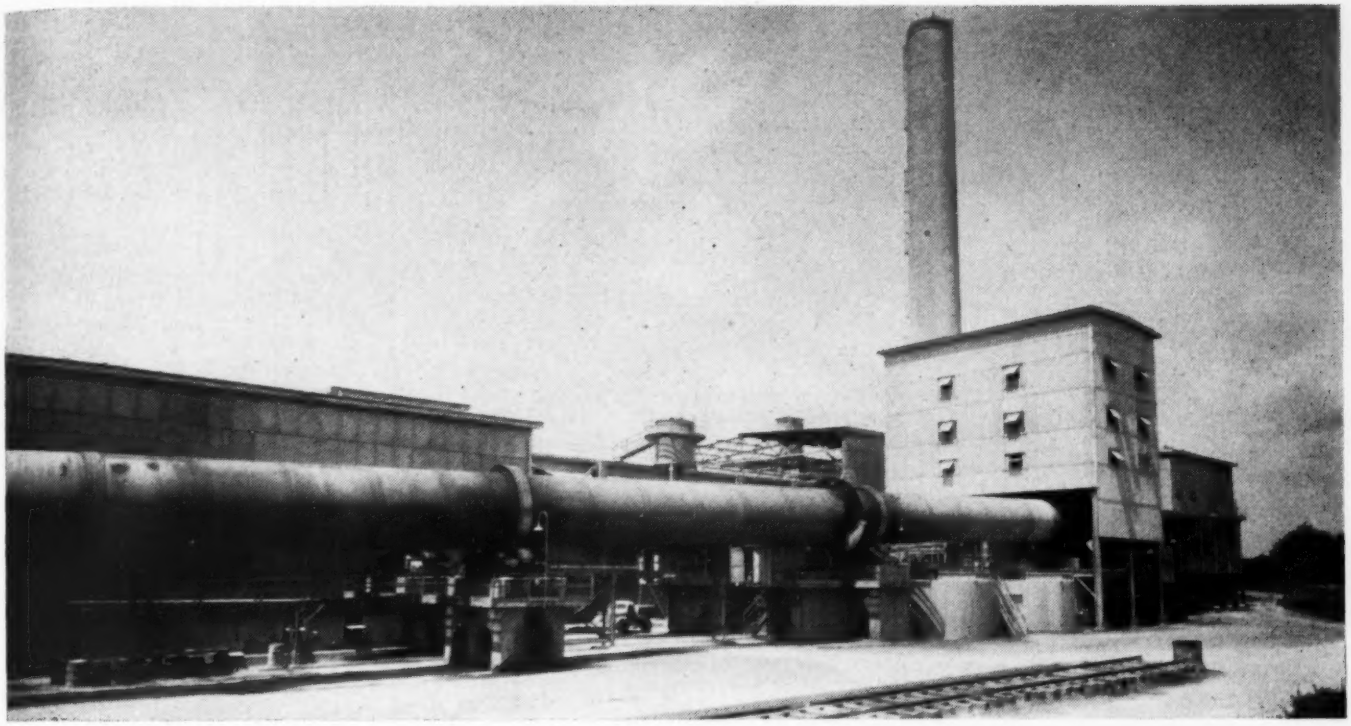
Mechanical limitations and not chemical considerations are the determining factor in the percentage of dust returnable into the kilns, and the figure 55 per cent is the maximum that can be converted into kiln feed with the type of slurry feed arrangement now in use. Dust is blended dry into the slurry from the kiln feed tanks as fed to the kilns, so no opportunity is afforded the hydraulic characteristics of fine dust to cause setting up complications as have been experienced in plants where dust comprises part of the slurry in storage and blending tanks.

Moisture content of the fresh slurry averages about 33 per cent. After the slurry is pumped to the kiln feed floor, the arrangement is for gravity feed down into the kilns, equipment consisting of a Smidth spiral scoop feeder and a feed tank which has an overflow weir in the center and is located at the next lower floor level. In this arrangement, which has been found effective by Universal Atlas, slurry enters the tank tangentially, with a swirling action that keeps it from settling and which minimizes the ever present tendency of slurry to build up and clog within the delivery pipe and kiln feed pipe. A vortex forms at the overflow into a 6-in. center pipe which delivers slurry by gravity into an 8-in. inside diameter water-cooled kiln feed pipe. Each kiln has a separate feed unit.

Dust is proportioned by volume and intermixed with the slurry by intro-



Interior of substation, showing panel contol board; rectifiers in background



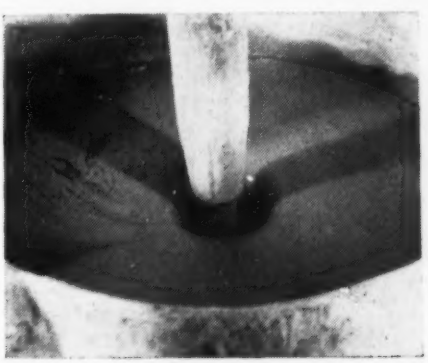
View of plant in full operation; two 300-ft. kilns may be seen to the left and to the right is kiln feed house. To the right is the new dust collector

ducing it uniformly, via vertical pipe, into the slurry vortex discharge where it literally is enveloped into the slurry as the slurry flows down into the kiln feed spouts. Trial and error runs have determined that 55 per cent is the maximum returnable volume of dust with this arrangement, added continuously into the slurry fed each kiln. A higher percentage has resulted in buildup and clogging of the feed line and kiln spout. Kiln feed, therefore, consists of 1075 lb. of fresh material, dry weight basis, plus dust. Slurry consistency from the kiln feed tanks is held at the original 33 per cent level and, therefore, the consistency of the slurry as fed into the kiln has been dropped probably two or three per cent by the addition of dry dust.

The remaining 45 per cent of the dust recovered is disposed of in the quarry, at present, from an 11-ft. diameter receiving silo that has a discharge arrangement to a screw conveyor that will permit return of dust from the silo to the kiln feed floor, should future development permit return of a greater quantity of dust into the kiln feed material.

An accurate arrangement of a dust feed bin with hoppered bottom, and screw conveyors positively regulates the flow of dust in the desired proportions to both kilns. Dust from the collector is elevated into this overhead hopper, between the kilns, which maintains a constant head of material, the excess (45 per cent of total) entering a 12-in. horizontal screw conveyor filling the disposal silo. A split hopper pays out dust from below to right and left screw conveyors delivering dust into the two 4-in. diameter vertical pipe through which dust is added into the slurry. Rate of speed of these horizontal feed screws determines the quantity of dust fed and therefore the amount of excess dust to be conveyed to disposal.

The entire installation is new and certain details have not as yet been completed, such as automatic adjustment of rate of feed of dust with changes in kiln speed which, we understand, is to be accomplished. Slurry feed rate is tied automatically to kiln speed and, for extremely fine accuracy, rate of dust feed can easily be synchronized as well with kiln speed. However, the kilns are operated at constant speed, using small variations in firing rates to adjust for heat requirements and there is no occasion for changing kiln speed unless under unforeseen circumstances. The kiln drives are 125-hp. 230-volt d.c. motors equipped with Ward-Leonard speed control, enabling accurate kiln speed regulation — an arrangement that will readily permit synchronization of rate of dust feed as well as slurry feed.



Showing continuous return of dry dust into slurry as fed to pipe leading to kiln

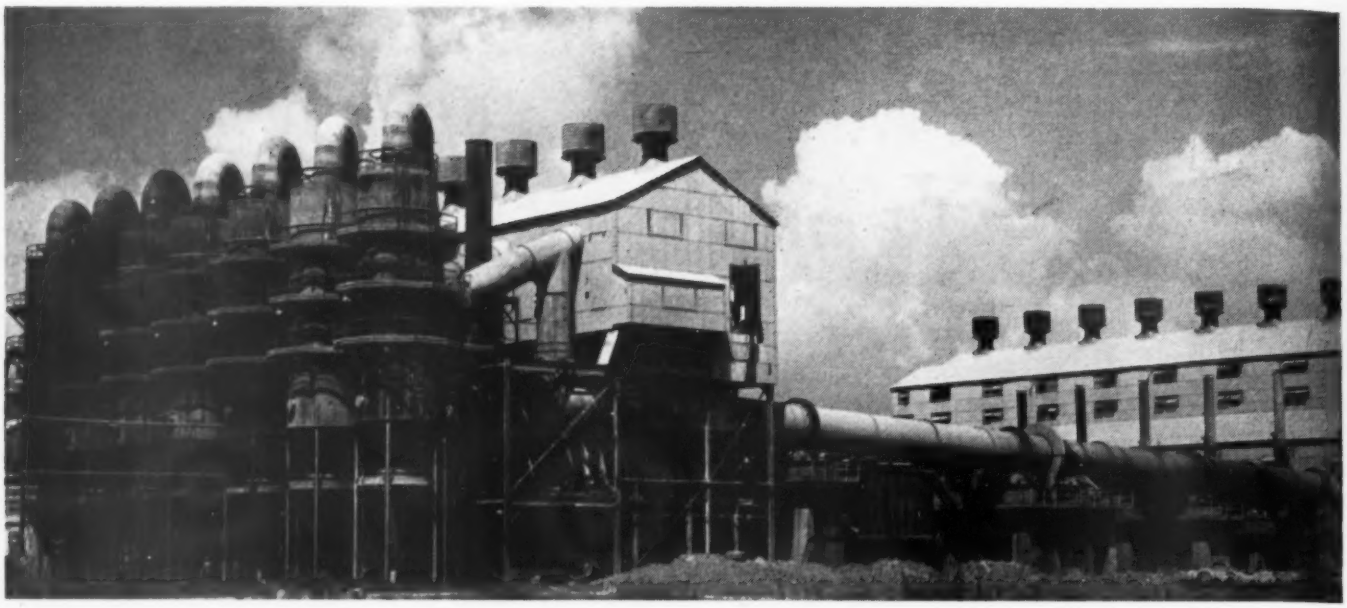
Addition of dust into the kiln feed at the rate adopted has not resulted in any complications or material changes in kiln operation. No difference in the frequency or extent of mud ring or clinker ring formation has been observed. There has been no evidence of undesirable increase in alkali content of the finished product. A very slight buildup in the silica ratio has involved a slight adjustment toward higher lime content in the proportioning of the raw materials, which are limestone, shale and sandstone at the Leeds plant.

Nevada Magnesium Ore Plant Up for Sale

WAR ASSETS ADMINISTRATION has placed the Gabbs, Nev., magnesium ore plant on the selling block. The property includes the greatest known deposits of magnesite in North America, totaling about 4990 acres; a complete small town (including hotel) and eleven steel frame structures containing complete milling equipment. The town and plant facilities, located in the middle of the desert near Hawthorne Lake, were developed by the government during the war to supply material for conversion to metallic magnesium at the Henderson plant of the project, near Las Vegas, 250 miles away.

Construction Approved

GALBRAITH & Co., Seattle, Wash., recently received approval from the Housing Expediter's office for construction of a $12,500 mortar manufacturing plant.



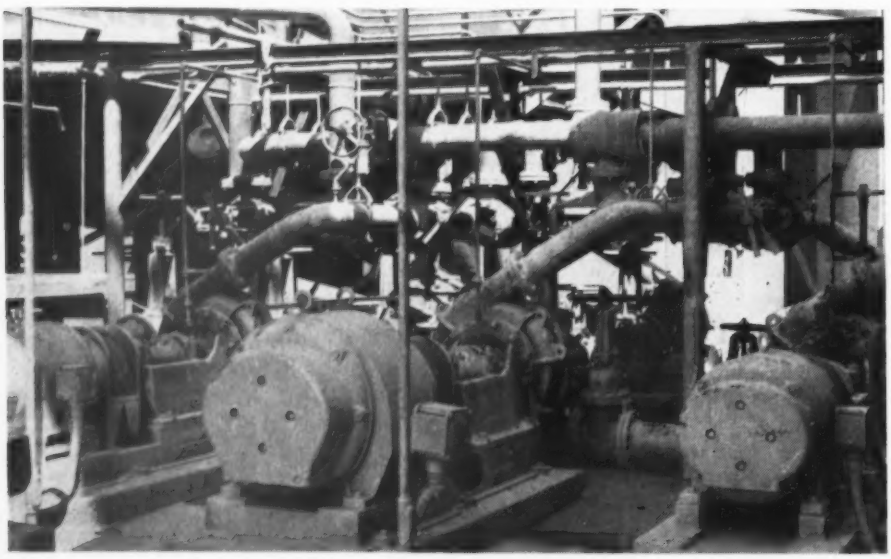
View of cement plant showing battery of kilns with hydraulic dust collectors in foreground

From Aluminum to Cement Manufacture

Ideal Cement Co. converts war-built aluminum plant at Mobile, Ala., to produce cement

SOME three-quarters of a million barrels of portland cement have been produced at Mobile, Ala., by the Alabama Division of Ideal Cement Co., since the first kiln went into production August 22, 1946, and the plant, built by Defense Plants Corp. to sinter alumina, is rapidly being converted into one of Ideal's largest capacity units. At the time the plant was purchased in May, 1946, the company considered the possibility of moving it or transferring major units of machinery to other mills scheduled for modernization but substantial export and domestic sales developed and the plant is scheduled to continue operation at the existing location for as long a time as the present heavy demand exists.

Located at the Alabama State Docks on Mobile river, the plant was built by the government during the war for security purposes as one unit in the processing of low grade bauxite ore, at a time when Nazi submarines threatened to cut off bauxite imports into Mobile. The plant never turned a wheel and was purchased in its entirety by Ideal in May of 1946.



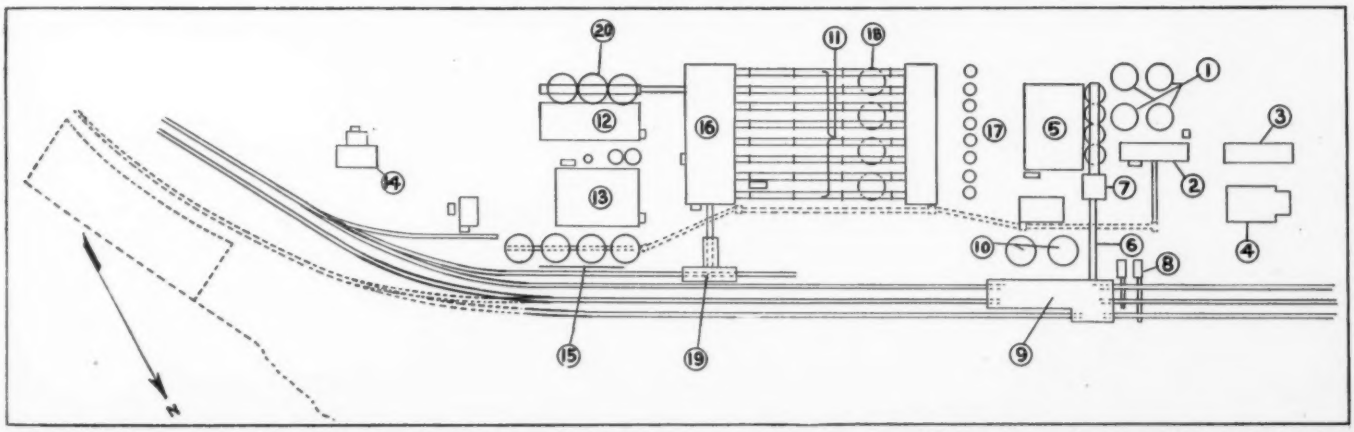
Battery of slurry pumps for handling slurry, correction, to kiln feed tanks, etc.

Conversion of equipment erected to process aluminum ore into a plant to manufacture portland cement was by no means an easy process, but has been accomplished in the face of a pressing demand for portland cement, largely by adapting mechanical equipment already in the plant to cement mill requirements. Much of the major equipment for sintering ore is similar to cement mill equipment, to be sure, but relative capacities of the various departments and the availability of storage facilities of already established capacity, but not in the right places and amount, necessitated considerable change of the flowsheet.

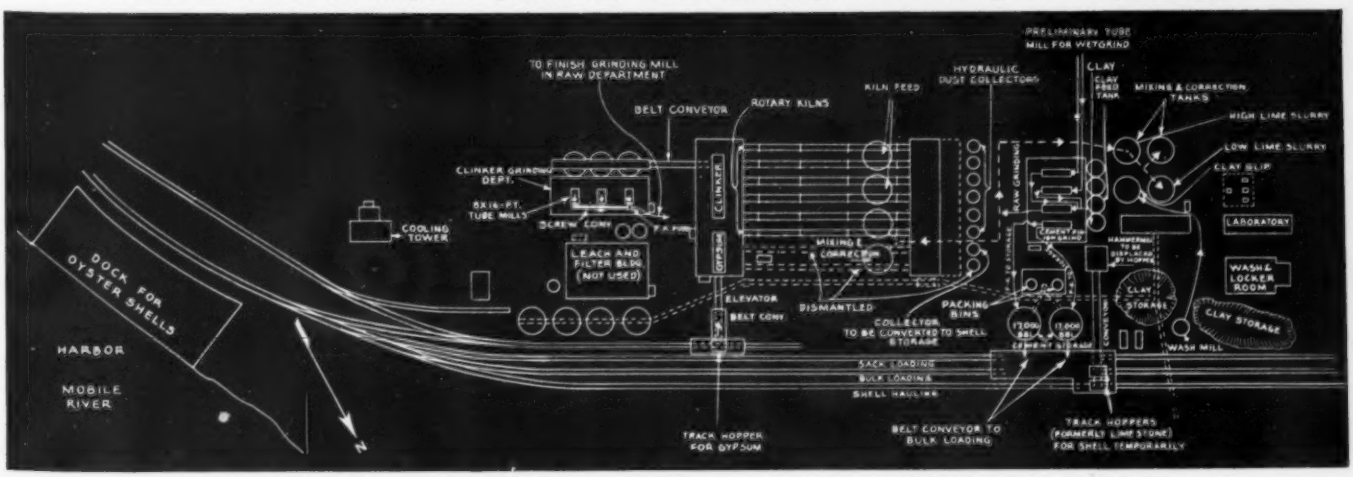
Furthermore, some of the major equipment was of types new or relatively untried in the manufacture of portland cement, certain units of which are being by-passed at present in the interest of high production but under consideration for later re-incorporation into the cement mill flowsheet. Other units will require experience in their adaptation to cement manufacture, having originally been installed for the processing of other materials, and much equipment purchased in the complete transaction while essentially cement mill type equipment, is excess and will be utilized in other plants of the company.

As was to be expected, in plants built out of government funds, every conceivable mode-n practice, equipmentwise, had been incorporated into the plant. The eight rotary kilns were fully insulated and equipped for firing

Battery of cement kilns, looking toward firing end

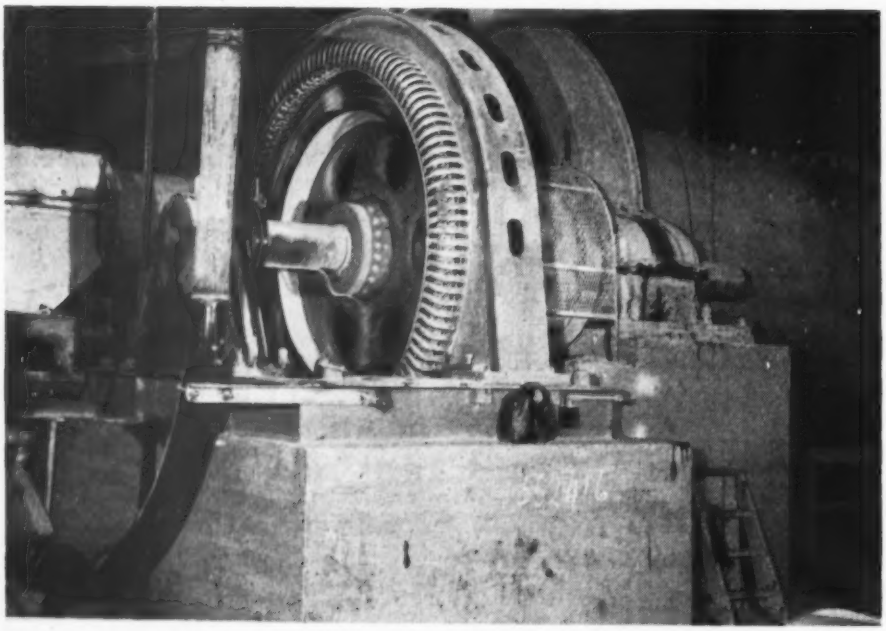


Sintering plant layout as taken over by Ideal Cement Co. Principal production units are: (1) red mud storage; (2) red mud dewatering; (3) laboratory; (4) wash and locker rooms; (5) grinding and stone storage; 6) limestone conveyor to crusher; (7) limestone crushing; (8) car pullers; (9) limestone unloading; (10) soda storage; (11) sinter kilns; (12) sinter grinding; (13) leach and filter section; (14) cooling tower; (15) sinter liquor tanks; (16) overhead coal storage; (17) gas scrubbers; (18) kiln feed tanks; (19) coal handling; (20) conveyor building

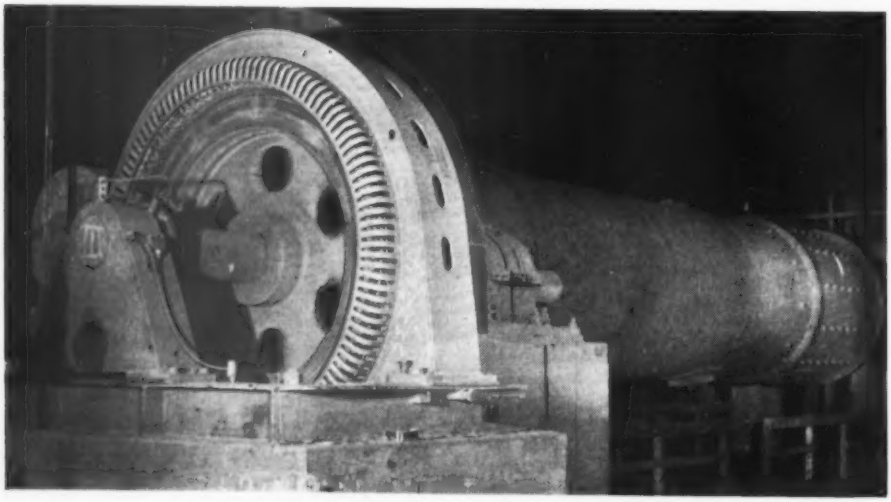


Layout of plant (see accompanying drawing) showing how facilities have been adapted for cement manufacture

Looking down into kiln feed slurry tank



Close-up of one of three 8- x 16-ft., two-compartment tube mills. To the left may be seen cement pump to deliver discharge of all three mills back to original raw mill for finish grind through one 7- x 40-ft. mill



One of the 7- x 40-ft., two-compartment raw grinding mills

either by natural gas or by direct-firing coal mills. Instrumentation was provided wherever possible and, we might add, for the control of operations that we have never seen adapted to instrument control. A modern and complete laboratory ideally suited to the needs of the cement mill chemist was ready for immediate use.

Kilns

There were eight 9 ft. 6 in. x 250-ft. all-welded Traylor rotary kilns in the plant, each equipped with a hydraulic dust collector of a type new to the portland cement industry, and operated in conjunction with Traylor-Cheesman tubular clinker coolers. One entire unit has been dismantled and shipped to the company's Houston, Texas, (Gulf Portland Cement Co.) plant and a second is being installed at the company's Okay, Ark., (Arkansas Portland Cement Co.) plant. One of the two large vertical dust collectors involved has been left intact at Mobile for conversion into a bin.

Four of the remaining six kilns are producing clinker at the rate of 4000 to 4500 bbl. per day; No. 5 kiln will be used alternately for either the burning of clinker or chemical lime; and No. 6 kiln will be a lime kiln exclusively, according to present plans.

Raw Materials

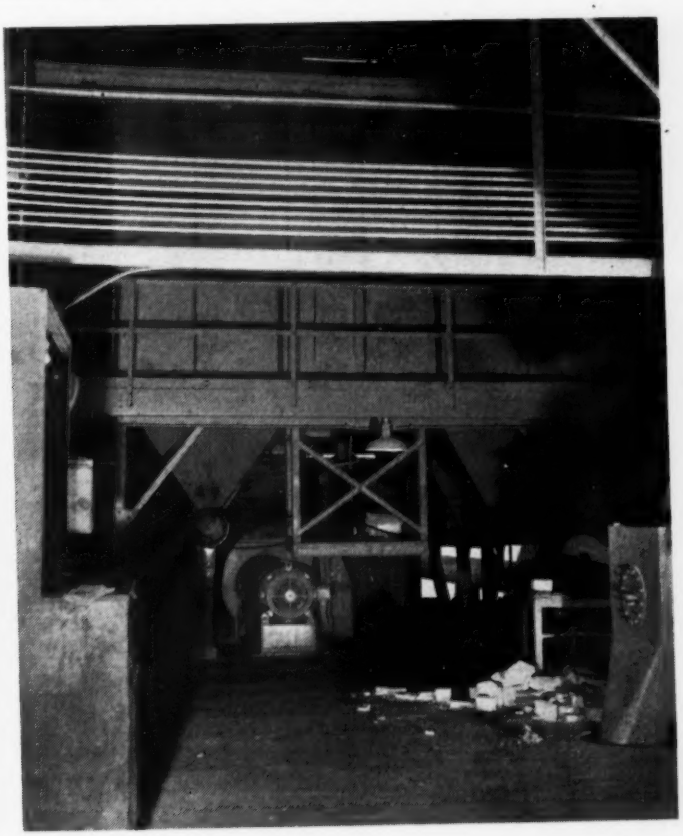
Oyster shells dredged from Mobile Bay constituted the logical source of calcareous raw materials and clay is secured from a nearby source. The plant as built had no dock facilities, the plan being to ship in limestone by rail, so one of the first projects in the conversion to cement manufacture was to build a dock and install handling facilities.

One of the accompanying sketches shows the plant as acquired, with designations according to original use for principal production units; the other indicates additions made and the use to which existing production units have been adapted.

To handle oyster shells, a tunnel and conveyor were installed to fill a hopper for loading into hopper-bottom railroad cars which have been dumping shell into the hopper provided in the original flowsheet to receive limestone. An inclined belt conveyor was the means of transfer to two large hammer mills, product of which was elevated into the bins adjoining the mill building. Considerable change will be made in the handling of shell to that point. The hammer mills are not required in the cement mill flowsheet and will be removed, and a receiving hopper installed at their exact location. Caterpillar wagons, to be substituted for cars in the delivery of shell, will dump oyster shell, for cement manufacture, into that hopper. Another projected plan is to use the water cooling tower (near waterfront) foundations in the building of

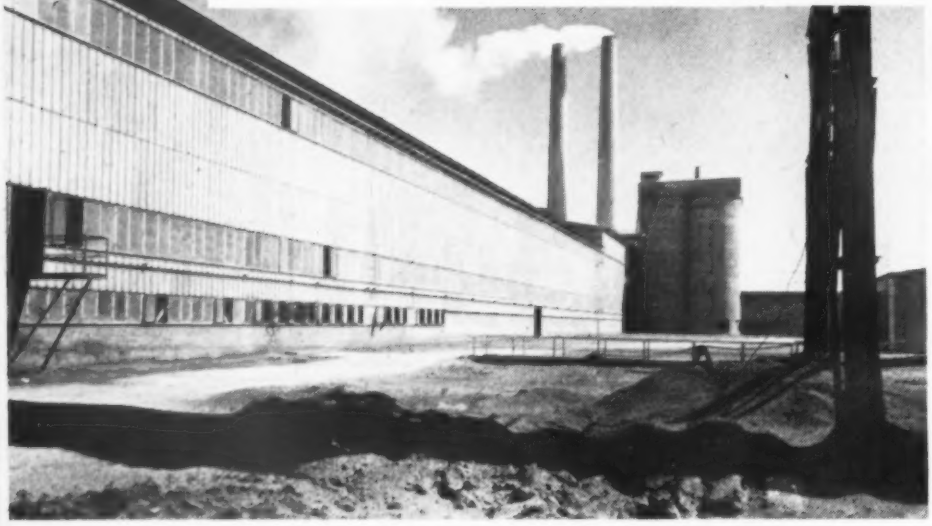
(Continued on page 172)

Looking down line of slurry evaporators installed in original plant for fuel economy



Left: Burner installation and kiln hood. Right: Dust collector installation in kiln room

Double the Capacity of Sweden's Most Modern Cement Plant



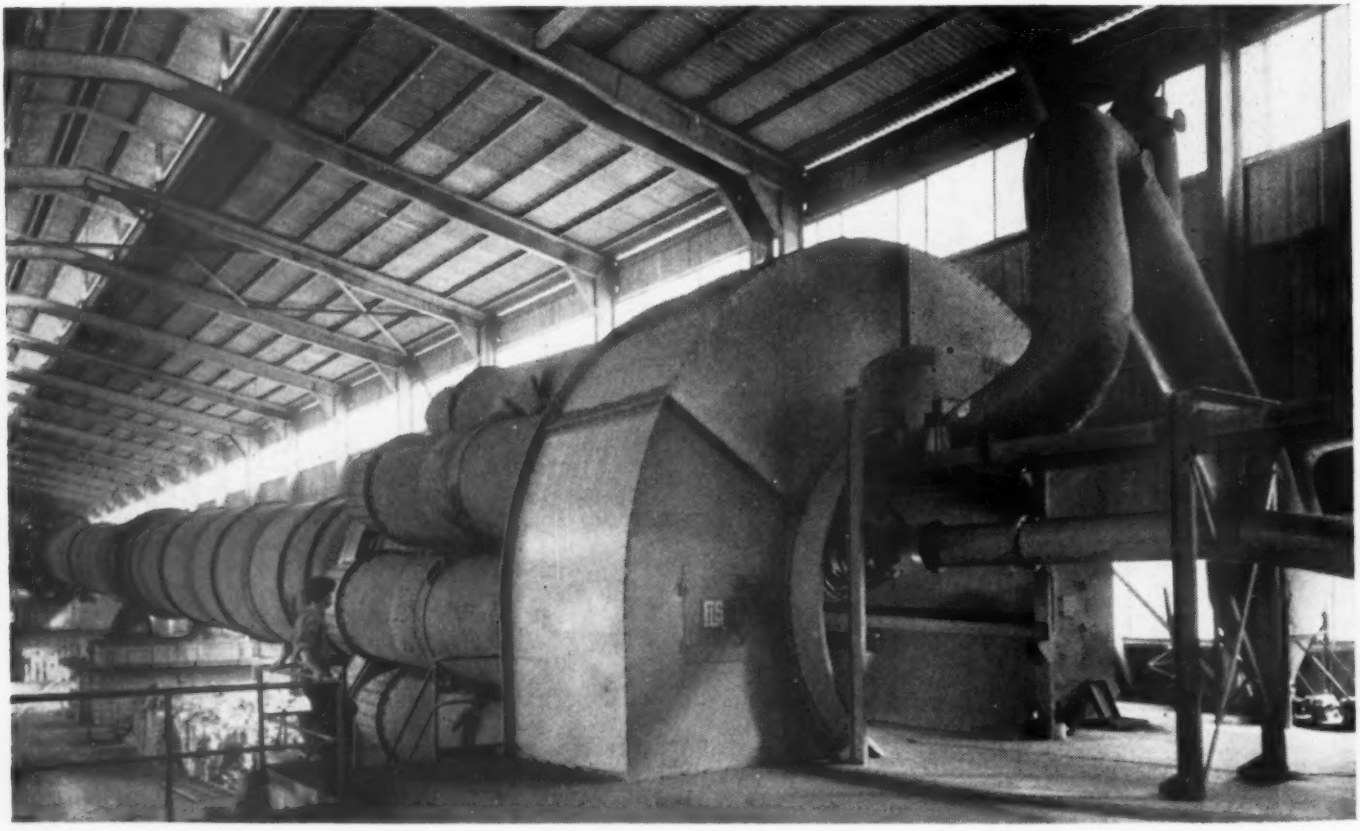
View of kiln room building at Skanska Cement Co. plant at Koping

Skanska Cement Co. places in operation a second wet process kiln, 475 ft. long. Built for coal firing, it now is using oil for fuel

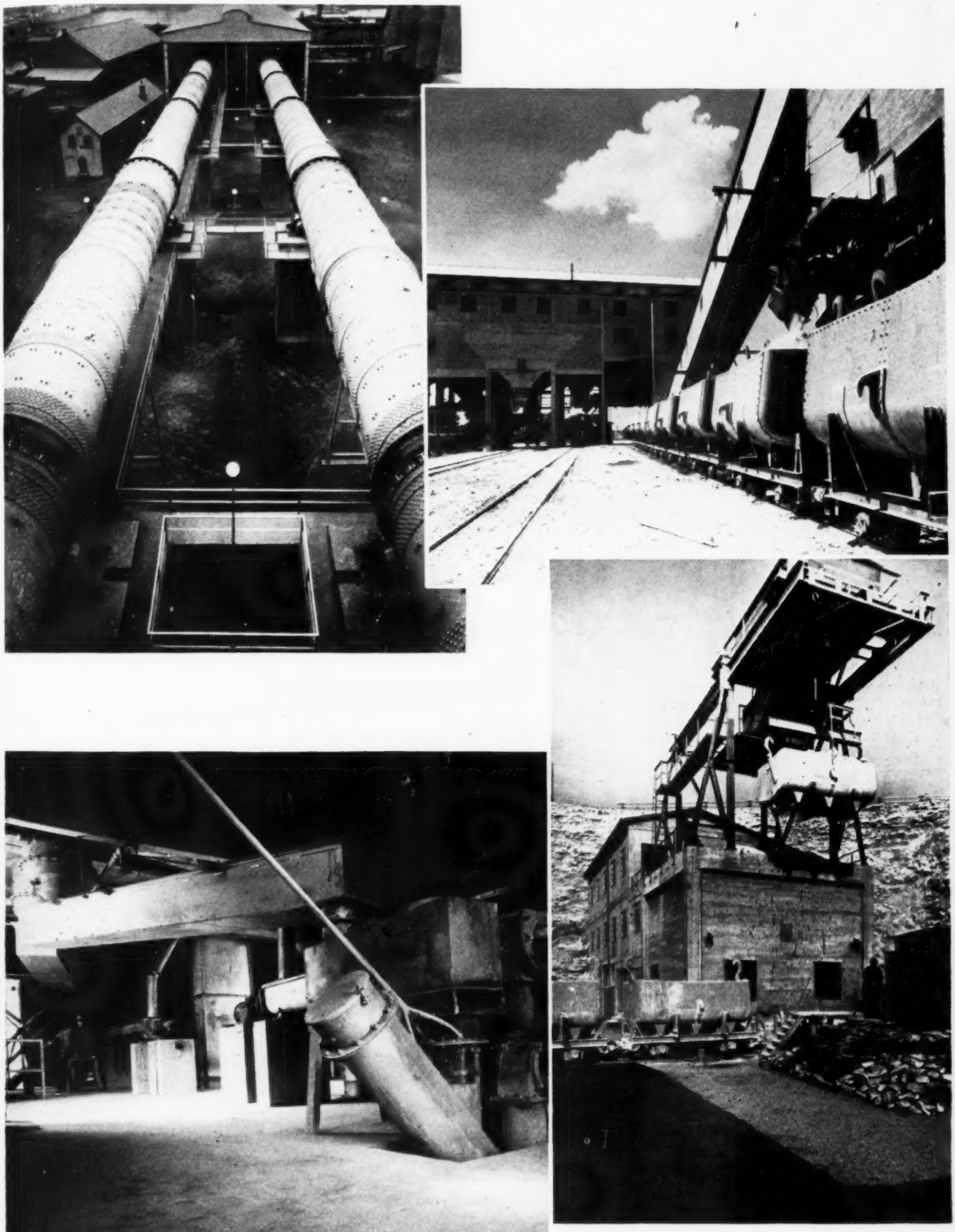
STARTING OPERATION in May, 1941, under the handicap of World War II, the new plant of Skanska Cement Co., at Koping, Sweden, placed in service only one of the two kilns for which the plant was originally designed. Diminishing demand for cement and a chronic fuel shortage made this decision imperative. In spite of these difficulties, the plant demonstrated some outstanding fuel economies with its long kiln, 10 ft. 10 in. x 11 ft. 10 in. x 475 ft., and its modern quarry and mill practices also contributed to its overall efficiency. A description of this plant as it operated up to the end of the War appeared in ROCK PRODUCTS, January, 1946.

With the war drawing to a close and with demands for cement piling up a backlog of orders to unprecedented levels, plans were rushed for the installation of the second kiln of identical dimensions and specification, although the slurry preheater is somewhat larger and was built into the kiln. On the first kiln the preheater was installed after the kiln had been in operation a couple of years and the fuel shortage was pinching harder than ever. The Unax or planetary type coolers are also larger on the second kiln because it had been found that the coolers were the bottle neck in the old kiln. Guaranteed capacity of the new kiln is 450 metric tons per 24 hours (2600 bbl.), and production at present is running around 2900 bbl. This boosts capacity another million barrels a year or a total of about 2,000,000 bbls. of cement for both kilns.

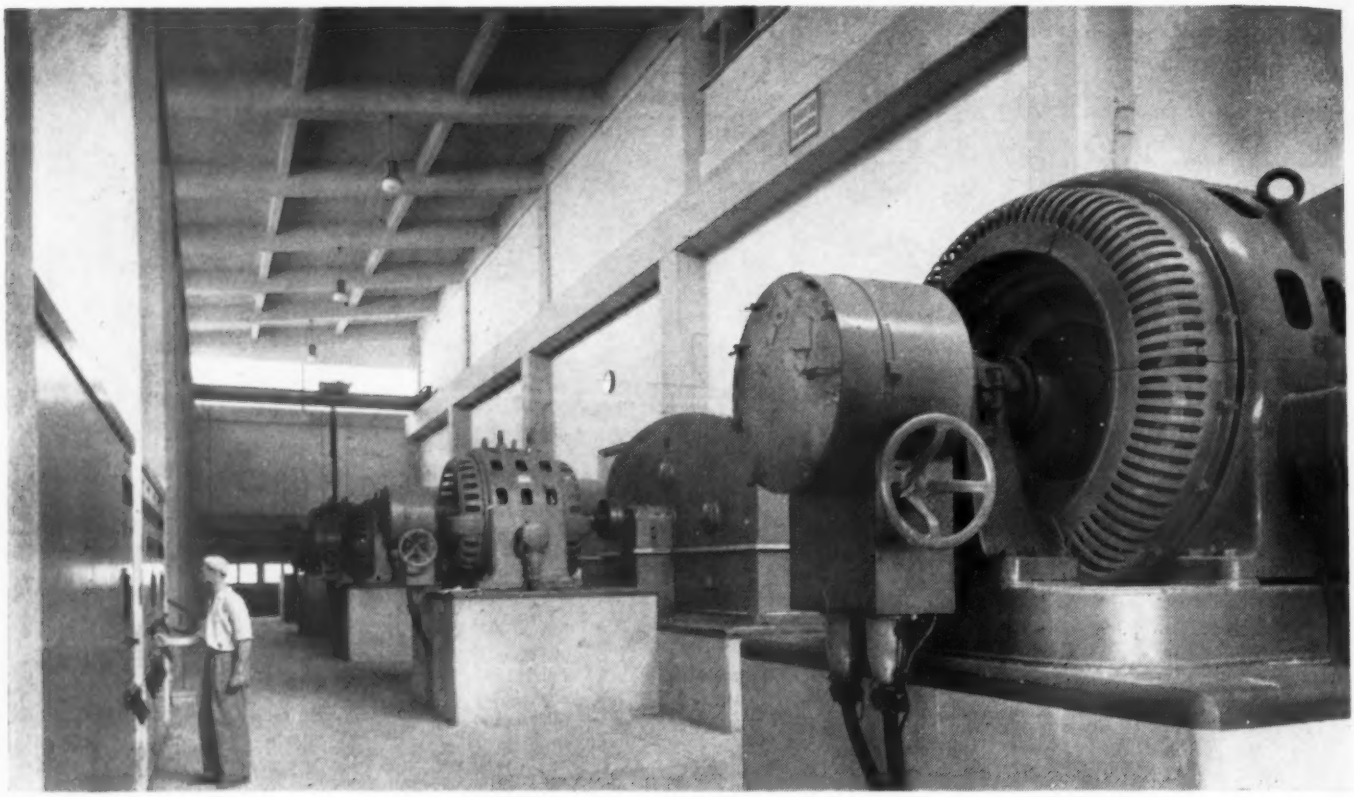
(Continued on page 144)



Firing end of one of the two long kilns



Quarry and mill views of Limhamn plant, Skanska Cement Co. Upper left: looking toward firing end of No. 7 and No. 8 kilns; below, slurry transport arrangement to kiln inlet. Upper right: Fully loaded bucket cars headed for the primary crusher; below, hoisted bucket above crusher bin



Grinding mill room is notable for its neat construction and cleanliness

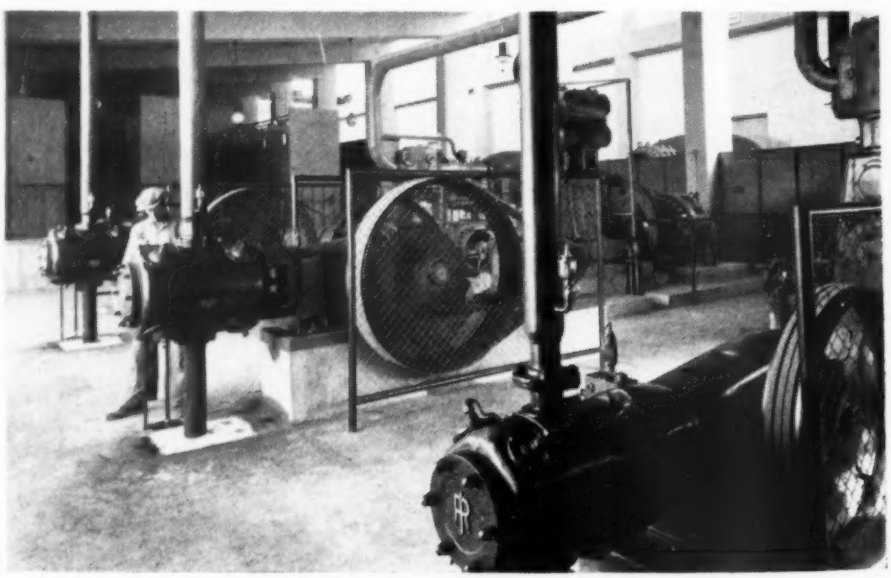
Although the new kiln, like the first unit, was built for coal firing, oil has been used since the start, because coal continues to be scarce and it is also slightly more expensive than oil. During the war, coal was mixed with charcoal, peat and sawdust to make it reach farther, but during 1946 the amount of substitute fuel was gradually diminished with the increasing supply of oil. With a high rate of employment and the consequent lack of manpower, it is almost impossible to produce peat and charcoal in Sweden. The fire hazard and the high cost (more than twice the price of coal) have made substitute fuels uneconomical. Both charcoal and dry peat powder are self-igniting and started numerous fires resulting in damage to buildings and machinery. Dry peat powder is somewhat less dangerous than charcoal. During the war when it was necessary to substitute these fuels considerable trouble developed from their use, but production was never stopped and by constand alertness fires were not permitted to spread.

As Sweden is located closer to coal fields than to oil fields, it seems logical to assume that coal eventually will be cheaper when conditions stabilize in the world. It therefore was decided to install an F. L. Smidth Tirex mill for drying and pulverizing coal. This direct-firing installation is the same as on the first kiln.

Direct firing has worked without a hitch even with the previously mentioned fuel mixtures, but starting up a cold kiln in the winter or in damp weather has at times been troublesome. When the coal is wet, it frequently has been difficult to ignite the fuel and maintain an even feed before the mill and piping has been heated properly. To remedy this condition, a small bin for dry and powdered coal is being installed for each kiln. This arrangement permits conventional direct-firing or the use of the old system of continuously feeding the burner from the powdered coal bin. Peak demands for fuel can be met when direct-firing by simultaneously drawing coal from the powdered coal bin.

Heretofore oil has never been used for fuel in cement plants in Sweden, and the innovation caught everyone by surprise. Quick make-shifts had to be made. At the Koping plant, two new reinforced concrete slurry silos were adapted for oil storage, a pipe line for pumping cement was converted into an oil line, and a couple of tanks from a scrapped ship were put up as day tanks. However, an oil storage tank of reinforced concrete holding 35,000 bbl. has been built, and the silos will be returned to their original use for slurry tanks. It is interesting to note that no oil has leaked through

(Continued on page 175)



Battery of compressors supply compressed air for many operations

INSULATION In Rotary Kilns

By W. R. CLIFFE*

Most operators and plant engineers are familiar with the savings that can be effected through the insulation of rotary kiln linings, but few of them have knowledge of the factors which contribute so importantly to the successful installation. This accounts for the preponderance of failures and the subsequent hesitancy in adopting this very practical procedure.

From "The Merchant of Venice," Act 2, Scene 7, we read:

"All that glitters is not gold,
Often have you heard that told."

Nothing I can say would nearly so adequately describe the serious consideration that should precede the actual insulation of any rotary kiln.

Figures dealing with minimizing of heat losses through the use of insulation under a wide range of conditions are easily obtainable. For excellent data in this field, I refer you to tables compiled by Ralph Gibbs in his article which appeared in the December, 1943, issue of ROCK PRODUCTS.

The purpose of this article is to deal with the practical aspects, so necessary if the savings often discussed are to be realized.

Rotary kilns were first insulated about 1924. It is not unusual for opinion to be divided in the case of new procedures, but usually with the passage of a few years it crystalizes one way or another. After 23 years the "yeas" and "nays" are still sharply separated. It is natural that the operator who has had unsatisfactory experience should be vociferous. Possibly it has not occurred to him that anything could be at fault except the insulating material or the principle. Let us see therefore, if we can outline the factors that have a bearing on the "standupability" of insulated rotary kiln linings:

*Consulting engineer, L.I.M.E., Hershey, Penn.

Circumferential Slip

In progressing from kilns of riveted to kilns of welded construction, we effected many improvements but insufficient importance has been attached to circumferential lining slip. Operators generally are aware of the fact that a certain movement in this direction exists, but few have definite knowledge of its extent.

In connection with ports through the kiln shell and brick work for the Cardox-Cliffe System of heavy coating dislodgment with CO_2, we have learned from actual experience, that it is not unusual for linings to shift as much as several feet per hour. Quite naturally there are factors which contribute to such a condition. One is the smooth bore of a welded kiln shell, another is that the lining was probably not jacked and driven tightly at the time of placement. In this matter of shifting, it is well to consider that each circumferential course of brick does not shift equally, therefore, there is abrasion on the radial planes of the brick as well as between the back of the block and the kiln shell. This continued rubbing results in a loss in gauge which can result in nothing but a gradual loosening of the entire lining. Furthermore, the fine, very abrasive particles of refractory brick which are ground off, usually find their way into the product as a contaminant.

In the interest of accuracy, it must be noted that where the outer face of the kiln liner has been prepared at the time of placement to fit tightly against the shell over the rivet heads, slippage in kilns of riveted construction does not occur. Unfortunately, in the usual rush to replace a lining, the depth of the rivet head is usually filled with a combination of ground brick and fire clay and the refractory structure placed thereon. The result is invariably a sloppy job for obvious reasons.

If linings are to be insulated, it is absolutely essential that one of the quarter blocks must be anchored. As in all things, there are several ways to accomplish this. The one shown in Fig. 1 is an approved method. Blocks carrying this cut-out are supplied by the leading manufacturers of rotary kiln shapes.

By ordering half blocks, properly designed, the racking (joint breaking) of the refractory work can be started on top of insulation with the adjoining block. This arrangement gives more insulating backing than would be the case if every other anchor block was reversed and half blocks of full depth were placed next. This is shown in Fig. 2. Such procedure is frequently used but is complicated and has little to commend it.

Through Blocks on the Quarters

In small bore kilns (diameter 6 ft.) it is not necessary to carry through

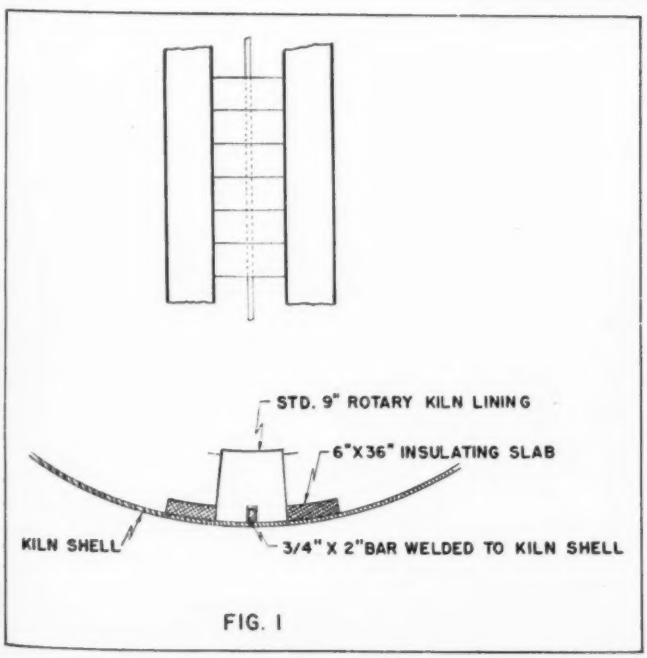


Fig. 1: Approved method of anchoring quarter blocks

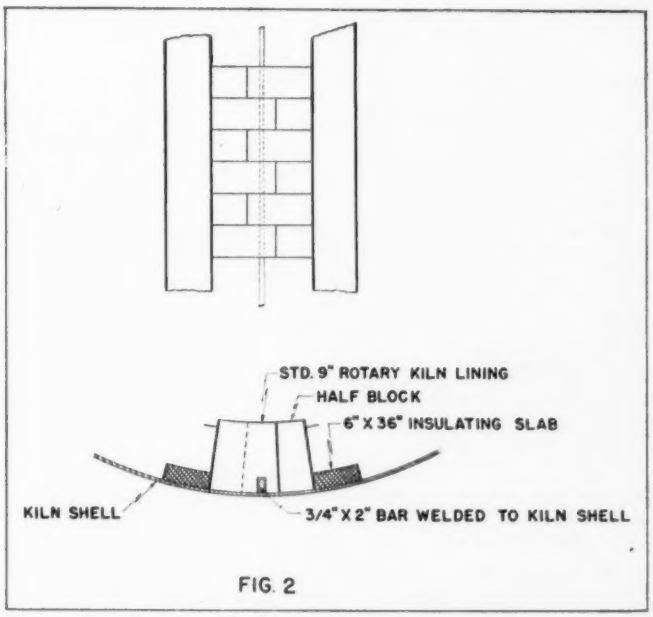


Fig. 2: Method of using properly designed half blocks

blocks to the kiln shell but in kilns of greater diameter it is important to do so. For the moment, our best insulating slabs lack mechanical strength, it is therefore considered necessary in the interest of rigidity and firmness to carry refractory blocks through to the kiln shell at the quarters.

This, of necessity, complicates the placement of both refractory and insulation, however, as in the case of Figs. 1 and 2, the through blocks can be laid in a straight line with the insulating slabs laid in close at the base. The joint breaking is started on top of the insulation at the next full or half block.

Circumferential Through Blocks

At 21-ft intervals it is suggested that two or three full courses of full depth blocks be placed against the shell. Twenty-one feet is suggested because it permits the placement of seven full length slabs of insulation. It is not necessary to anchor these blocks to the shell because it is thought that side friction against the anchored insulated section will prevent slippage. The purpose of these rings is to permit longitudinal joint breaking and added rigidity to the balance of the lining mounted upon the insulating material.

Placement Technique

Many operators are quite content to leave the placement of the kiln lining and insulation to an "old timer." Whether he has been engaged in such work all his life or whether he is a younger, more inexperienced man, the importance of the job demands a responsible plant supervisor in attendance at all times. Only one bad key or another equally thoughtless move can cause the loss of a section of lining. Kiln lining and insulation in place seldom costs less than $50 per foot, and hot zone lining costing up to $200 per foot is not unusual. Furthermore, almost any kiln in producton is worth a minimum of $40 per hour. In view of the critical nature of the work underway, it would seem to justify experienced supervision from the head office.

In my experience in many plants I have seen the old time masons favorite mud placed in radial joints to a thickness of one inch, blocks improperly driven home, keys far too thin for safety, excessive use of portland cement in mud, paving blocks laid in hot zone for patch work and other instances of bad practice far too numerous to mention. And these were going into what was intended to be the finished kiln lining. Proper supervision should prevent such practices which are often the cause of failure or sub-normal life.

In addition, at about the time the last key is driven the rush to fire the kiln is usually so great that no studied final inspection by someone in authority is made. Consequently, much inferior workmanship is forever covered up and will probably be repeated at the next lining repair job.

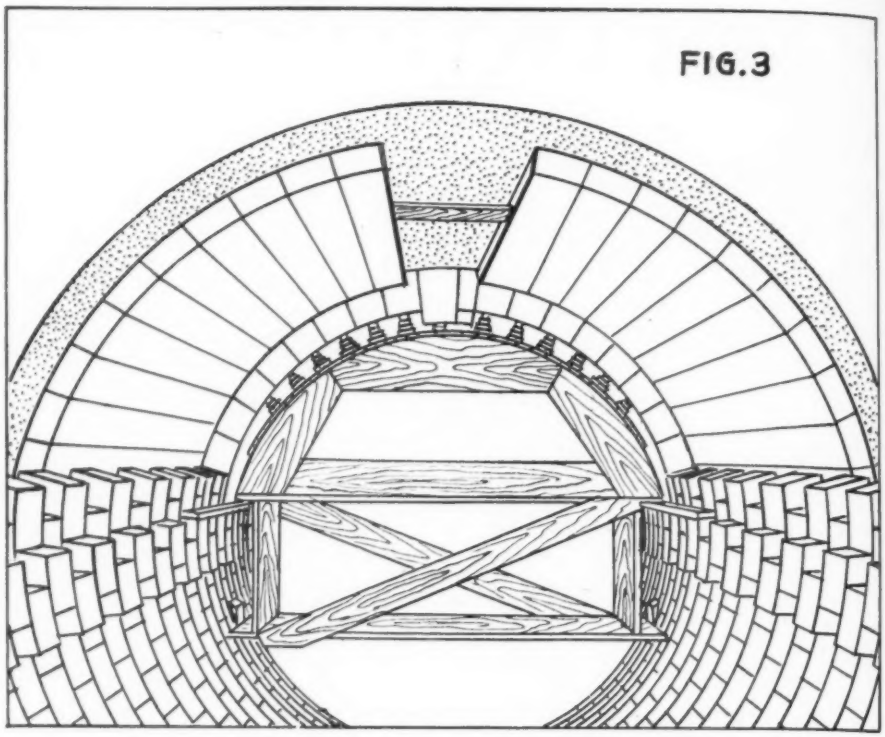


Fig. 3: Arch form method of placing lining on insulated backing

Lining logs recording who placed what type of brick, where, and under what conditions, are all too rare. It is not possible to plan kiln shutdowns intelligently, to maintain brick inventories and to establish accurate costs without full and complete kiln lining experience. The same chap under whose direction the lining and insulation is placed should be responsible for maintaining adequate inventory. More about this later.

A number of systems for blocking, jacking, wedging and forming linings and insulation into place have been studied with the idea of reporting herein.

Fig. 3 shows the arch form method of placing lining on insulated backing. My objections to this type of placement are that—

(1) It is too complicated.

(2) It is too slow.

(3) I do not believe it possible to lay insulation and brick as tightly as it is necessary to place it, if the job is to be successful.

Fig. 4 shows the jack method of placing lining on insulated backing in its first position. While it has certan fundamental weaknesses, I believe its overall possibilities for a satisfactory job are better than any other method within my experience.

Fig. 5 shows the jack method in its second position after a quarter turn of the kiln.

Fig. 6 shows the jack method in its third position. At this point wooden spreaders or jacks should be placed in order to prevent any possibilities of lining shifting by gravity.

Fig. 7 shows the jack method in final position for keying.

If lining supported by insulation is to fullfill its promise, it must be placed with the greatest of care. The following are most of the important do's and don'ts:

(1) Kiln shells should be perfectly clean before placement of insulating slabs begins.

(2) Insulating slabs should be ordered to conform to the inside curvature of the kiln shell.

(3) Before placing insulating slab, a thin even coat of cement of proper characteristics should be spread on the kiln shell. I prefer Harwaco Bond because of its air setting and adhesive characteristics. The insulating slab should be pressed firmly and evenly into place with a thin coat of the same cement on each of the sides where it will position against other insulation. Care should be taken to draw up both longitudinal and circumferential joints as tightly as is possible without damaging the slab.

(4) In kilns of riveted construction, the insulating slab must be dressed to accommodate all rivet heads so that slab rests neatly against the steel shell. The coating of refractory cement should cover rivet heads as well as the shell proper before placing the slab.

(5) Masons or other workers in the kiln must not walk on the slabs or disturb them in any way, once they are placed.

(6) The insulating slab except at the key position, should never be reduced from its original size. Small pieces of insulation and the subse-

quent jointing which cutting involves, are dangerous in that they add to the ever present lack of mechanical strength.

(7) Only the bottom or outer face of the kiln liner should be dipped in thin high temperature cement before it is dropped into position.

(8) All refractory liners should be laid dry. No clay, high temperature cement or other bonding agent should be used. To use any sort of bonding media leads toward a monolithic lining for which the rotary kiln is not designed. Please refer to W. F. Rochow's article, Refractory Linings for Rotary Cement Kilns, ROCK PRODUCTS, January and March, 1945, in which he proves the constant flattening or sag with every revolution. No grouting of any kind should be swept on a newly completed lining.

(9) I recommend a very slight taper on two sides of a rotary kiln liner to minimize inner face pinching and subsequent spalling. The taper should begin about 2½-in. from the inner face of the brick.

(10) All refractory liners should be drawn tight with a 2-lb. rubber mallet. Such a mallet will never damage the block and its resilience has a tendency to bring blocks into closer contact than is possible with the sharp blows of the typical metal masons hammer.

(11) Before measuring for the key, that particular course should be rubber malletted energetically with the idea of working back any slack which may have occurred in the jacking or kiln turning. This is important. When it is certain that all slack has been minimized, the tightest key possible should be machine cut and driven home from the side. Keys should never be less than half of the width of the original block.

(12) In connection with the fine type of workmanship required to place insulation supported refractory linings, the dressing of all key and other special shapes by power saw is a "must."

(13) Before a newly laid lining is fired, every circumferential course should be examined for slack. If the slightest evidence is found it should be removed by driving 10-, 12- or 16-gauge soft steel plates of proper width and depth between the blocks. These should not be allowed to penetrate the insulating backing. Before firing, the lining should be very tight against the insulated backing at every point on the circumference.

(14) Whenever the kiln is cooled, every circumferential course of brick should be checked for sag or slackness. This will usually be most noticeable at the top of the kiln. The business of driving steel plates should be resumed and continued whenever the opportunity presents itself.

Brick Inventories

The maintenance of an adequate supply of brick for rotary kiln lining replacement has heretofore been considered a simple job that almost took care of itself. With the advent of insulation and the increased number of special shapes and sizes that are now an integral part of a modern lining, it is important that special consideration be given to this problem.

The following list includes the material which ordinarily should be inventoried for an average rotary kiln:

(1) Feed end corbelling—may be special shapes or possibly they are built up out of standard 6-in. and 9-in. liners. In the latter case, unless the brick for each course are ordered with care they will require individual shaping for which a power saw is recommended for finer work and faster placement.

(2) Ordinarily, the first 10 ft. from the feed end is uninsulated, the blocks being placed against the kiln shell. A tough wearing resisting block of uniform burn is important. Greater than average depth can be used because this section ordinarily remains in place until it wears out. Five years life is not unusual.

(3) In kilns that employ heat exchange media or chains, the next 30 to 60 ft. is usually of the same type of brick (laid against the shell) as the 10 ft. preceding it. It may, however, be of lesser depth.

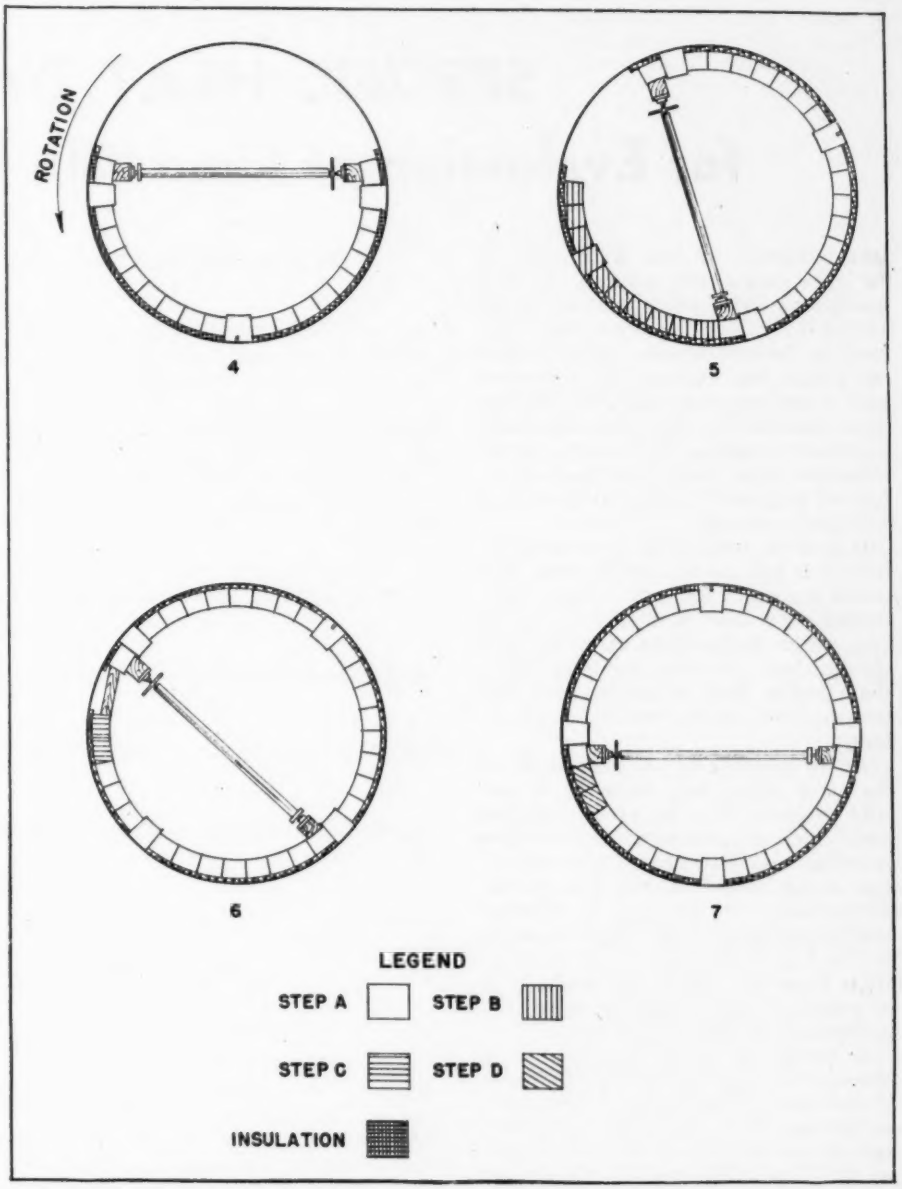
In kilns where nether chains nor heat exchangers are employed, the lining may be insulated in this zone. I do not agree with the school of thought which contends that feed end insulation merely increases the temperature of the existing products of combustion. If this section is insulated, the inventory should include:

(a) Full depth anchor blocks.

(b) 6-in. full blocks above insulation.

(c) 6-in. half blocks above insulation.

(Continued on page 168)



Steps in jack method of placing lining on insulated backing. Fig. 4: First position. Fig. 5: Second position after quarter turn of kiln. Fig. 6: Third position. Fig. 7: Final position

SPECIFIC HEAT DATA
for Evaluation of Lime Kiln Performance

By J. A. MURRAY*

CALCULATION of lime kiln performance necessarily involves the estimation of data which cannot be obtained by direct measurement. In making these estimates, reliance must be placed on engineering judgment and interpretation supplemented by data obtained by direct measurement, wherever possible. Any errors in the measured data may cause serious errors of judgment in the calculation of kiln performance.

One of the sources of error in calculations is the use of specific heat data which are valid for only a single temperature or over a narrow temperature range, rather than using the true specific heat obtained by integrating the specific heat equation over the temperature range which is of interest.

As an example of the magnitude of the error which may be made, a specific problem may be cited. Assume high calcium quicklime entering the cooler at a temperature of 2000 deg. F. and being cooled to 400 deg. F. by air initially at 60 deg. F. flowing countercurrently with a lime-air ratio of 1 to 1.25. Assuming no loss by radiation from the cooler, the problem is to calculate the temperature of the preheated air leaving the cooler.

A commonly used handbook of chemical data gives the specific heat of CaO as 0.177 at 0 deg. C. and 0.197 at 100 deg. C. It also gives the specific heat of air as 0.243 at 400 deg. F. and as 0.277 at 1000 deg. C. Using the value 0.20 for CaO and 0.25 for air, the temperature to which the air is preheated may readily be calculated to be 1085 deg. F.

If, however, the true specific heat of CaO over the range 400 deg. to 2000 deg. F. is obtained by integration of the specific heat equation, it is found to be 0.252. Using this value and that of air over the range 60 deg. to 1350 deg. F., it is calculated that the temperature to which the air is preheated will be between 1330 deg. and 1340 deg. or about 250 deg. F. higher than is obtained from the handbook data.

A critical review of high temperature specific heat data has been published by the Bureau of Mines.[1] The equations recommended by them are probably the most representative which are available at present and have been used as the source of data for these calculations. Their equations are expressed in terms of specific heat per mol as a function of the Kelvin temperature scale. For most industrial work in the lime industry, the equations are more usable is translated into specific heat per pound as a function of the Rankine temperature (deg. F. + 460). When so translated, the Bureau of Mines equations become

The equations present the specific heat of the compound under consideration at any desired temperature. By taking the definite integral of the equation over any desired range of temperature, an integrated specific heat value, valid for that particular range may be obtained. These integrated specific heat values are readily adaptable to nomographic representation and the nomograph for each compound is presented in the figures.

$$CaCO_3 - C = 0.1968 + 0.0000661\ T_R - \frac{9966}{T_R^2} \quad (3\%, 32^\circ \text{ to } 1400^\circ)$$

$$MgCO_3 - C = 0.1216 + 0.0001815\ T_R - \frac{1230}{T_R^2}$$

$$CaO - C = 0.1786 + 0.0000480\ T_R - \frac{6249}{T_R^2} \quad (2\%, 32^\circ \text{ to } 1650^\circ)$$

$$MgO - C = 0.2695 + 0.0000165\ T_R - \frac{16779}{T_R^2} \quad (2\%, 32^\circ \text{ to } 3300^\circ)$$

$$CO_2 - C = 0.2350 + 0.0000345\ T_R - \frac{14{,}396}{T_R^2} \quad (1\tfrac{1}{2}\%, 32^\circ \text{ to } 1700^\circ)$$

$$N_2 - C = 0.2321 + 0.0000196\ T_R - \quad (3\%, 80^\circ \text{ to } 4900^\circ)$$

$$O_2 - C = 0.2584 + 0.0000045\ T_R - \frac{19{,}000}{T_R^2} \quad (1\tfrac{1}{2}\%, 32^\circ \text{ to } 5000^\circ)$$

$$H_2O - C = 0.4567 + 0.00000461\ T + 0.000000023\ T_R^2 \quad (1\tfrac{1}{2}\%, 80^\circ \text{ to } 4000^\circ)$$

From these equations, the equations for dolomitic limestone and dolomitic quicklime may be derived if it be assumed that calcium and magnesium are present in molar ratio and that the specific heat of the combination is equal to the sum of the specific heats of the constituents. Also, the equation for air may be derived, assuming 20.9 per cent oxygen by volume and neglecting the minor constituents. These supplemental equations are

$$CaCO_3 \cdot MgCO_3 - C = 0.1624 + 0.0001189\ T_R - \frac{5970}{T_R^2}$$

$$CaO \cdot MgO - C = 0.2280 + 0.0000348\ T_R - \frac{10{,}655}{T_R^2}$$

$$Air - C = 0.2372 + 0.0000161\ T_R - \frac{4406}{T_R^2}$$

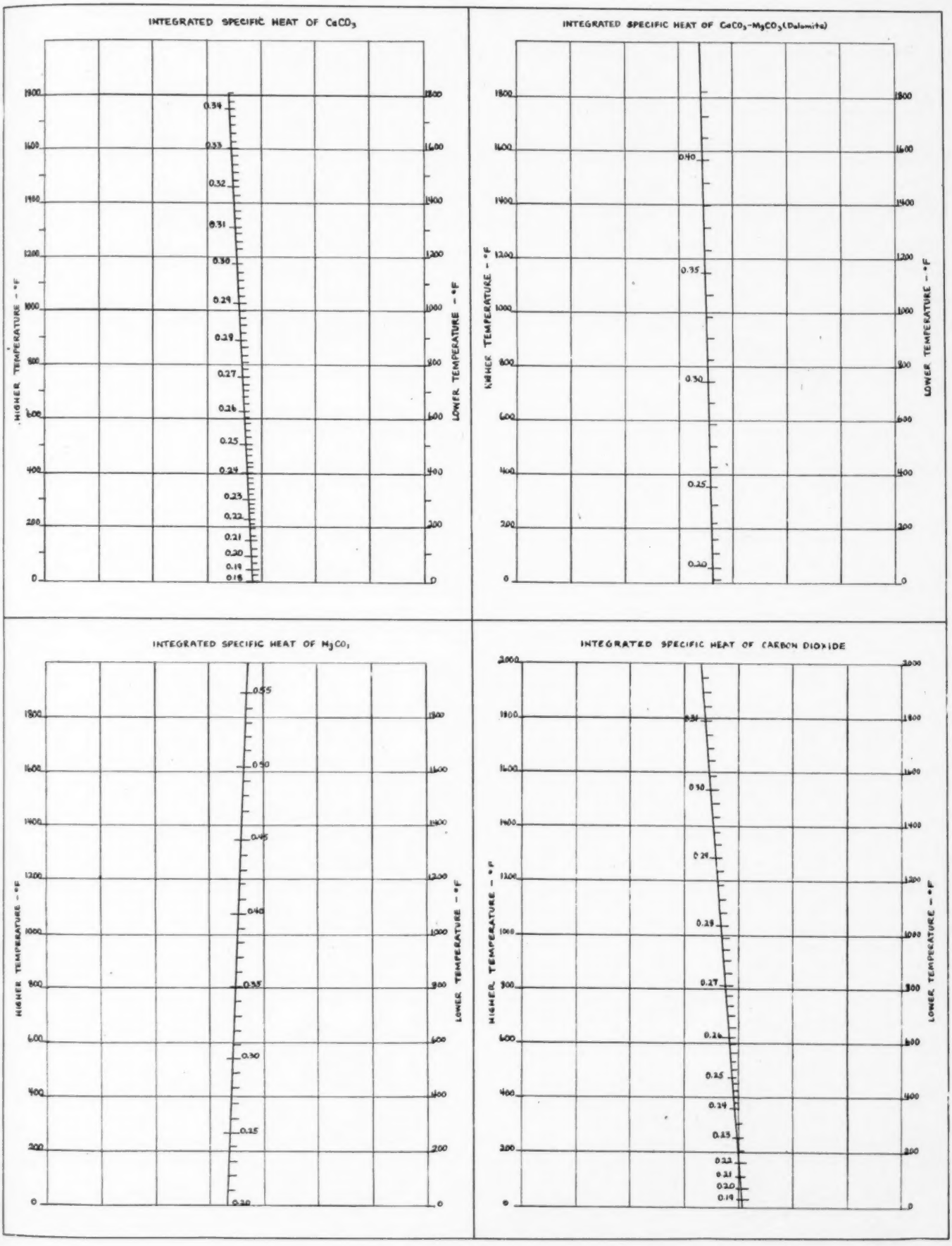
In the above equations, C is the specific heat, in B.t.u./lb., T_R is the temperature (deg. F. + 460); while the figures in parentheses show the average accuracy of the equation over the temperature range indicated as estimated in the Bureau of Mines publication.

In using these nomographs, a straight line is drawn between the higher temperature on the left hand scale and the lower temperature on the right hand scale. The intersection of this line with the center scale gives the integrated specific heat value over the range under consideration. Each nomograph has been checked by integrating the corresponding equation over approximately sixty different temperature ranges. The integrated value agreed with the value read from the nomograph within ±0.001 in about 75 per cent of the cases and within ±0.003 in all cases. Since this latter value is about 1½ per cent of the specific heat value and the accuracy claimed for the quation is from 1½

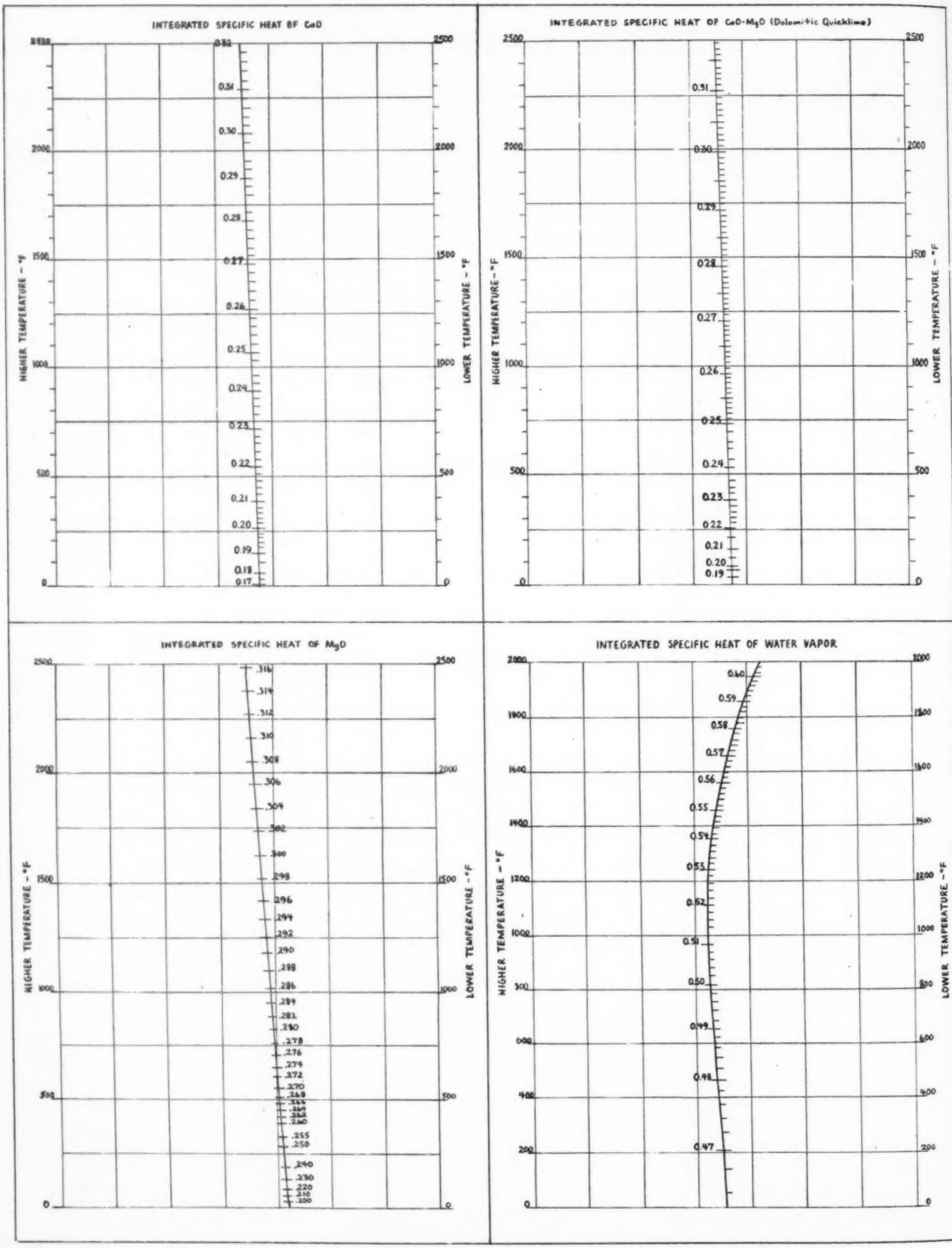
(See charts, pages 149, 150, 152)

*Research Director, Warner Co.

[1] U. S. Bureau of Mines Bulletin 371. "High-Temperature Specific-Heat Equations for Inorganic Substances."

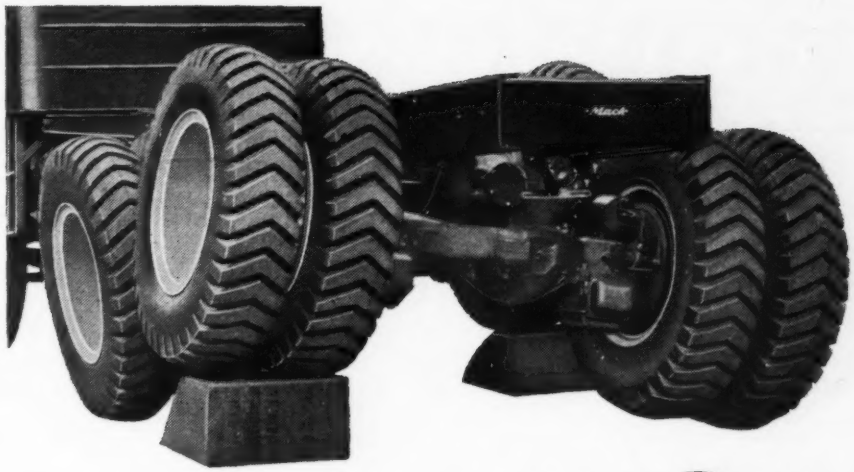

INTEGRATED SPECIFIC HEAT OF $CaCO_3$
HIGHER TEMPERATURE - °F
LOWER TEMPERATURE - °F
INTEGRATED SPECIFIC HEAT OF $CaCO_3$-$MgCO_3$ (Dolomite)
HIGHER TEMPERATURE - °F
LOWER TEMPERATURE - °F
INTEGRATED SPECIFIC HEAT OF $MgCO_3$
HIGHER TEMPERATURE - °F
LOWER TEMPERATURE - °F
INTEGRATED SPECIFIC HEAT OF CARBON DIOXIDE
HIGHER TEMPERATURE - °F
LOWER TEMPERATURE - °F

Nomographs or charts for quick determination of the total heat of various lime manufacturing materials between any selected temperatures. These charts involve calcium carbonate, dolomite, magnesium carbonate, and carbon dioxide


INTEGRATED SPECIFIC HEAT OF CaO
HIGHER TEMPERATURE - °F
LOWER TEMPERATURE - °F
INTEGRATED SPECIFIC HEAT OF CaO-MgO (Dolomitic Quicklime)
HIGHER TEMPERATURE - °F
LOWER TEMPERATURE - °F
INTEGRATED SPECIFIC HEAT OF MgO
HIGHER TEMPERATURE - °F
LOWER TEMPERATURE - °F
INTEGRATED SPECIFIC HEAT OF WATER VAPOR
HIGHER TEMPERATURE - °F
LOWER TEMPERATURE - °F

Charts for determination of total heat involved in calcium oxide, dolomitic quick lime, magnesium oxide, and water vapor

(Continued on page 152)



For GOOD Going on Bad Ground

Unmatched flexibility...without complications of design or localized strain...is an outstanding advantage of Mack's Balanced Bogie for six-wheeled trucks and tractors.

- Long, many-leaved springs freely trunnioned to the frame and yieldingly attached to the axles by huge rubber Shock Insulators assure fully flexible suspension. Wheels conform freely to road irregularities without the slightest twisting stress upon the frame. Even when traversing rough ground which causes the axles to slant in opposite directions the frame maintains its proper midway position. The suspension also maintains positive alignment of the axles for true tracking either straight ahead or on curves.
- To its inherent flexibility the Mack bogie adds the benefits of equal traction, even tire loading and uniform braking on all four wheels--regardless of road conditions. Because of its simple, sturdy construction and balanced stress distribution maintenance is greatly reduced.
- The Mack bogie is built complete in Mack factories. Its advanced and simplified design is further evidence of the forward-looking engineering that goes into the making of a Mack.

Mack six-wheel trucks, embodying Mack's exclusive Balanced Bogie have earned an enviable reputation in quarrying and mining service because of their unfaltering ability to cope with the toughest terrain.

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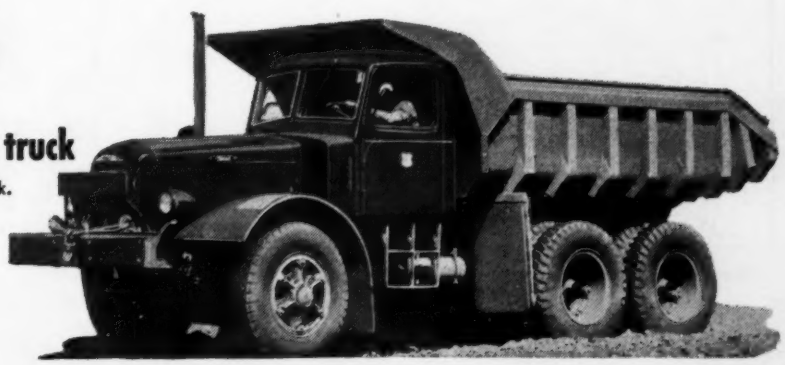
Trucks for every purpose



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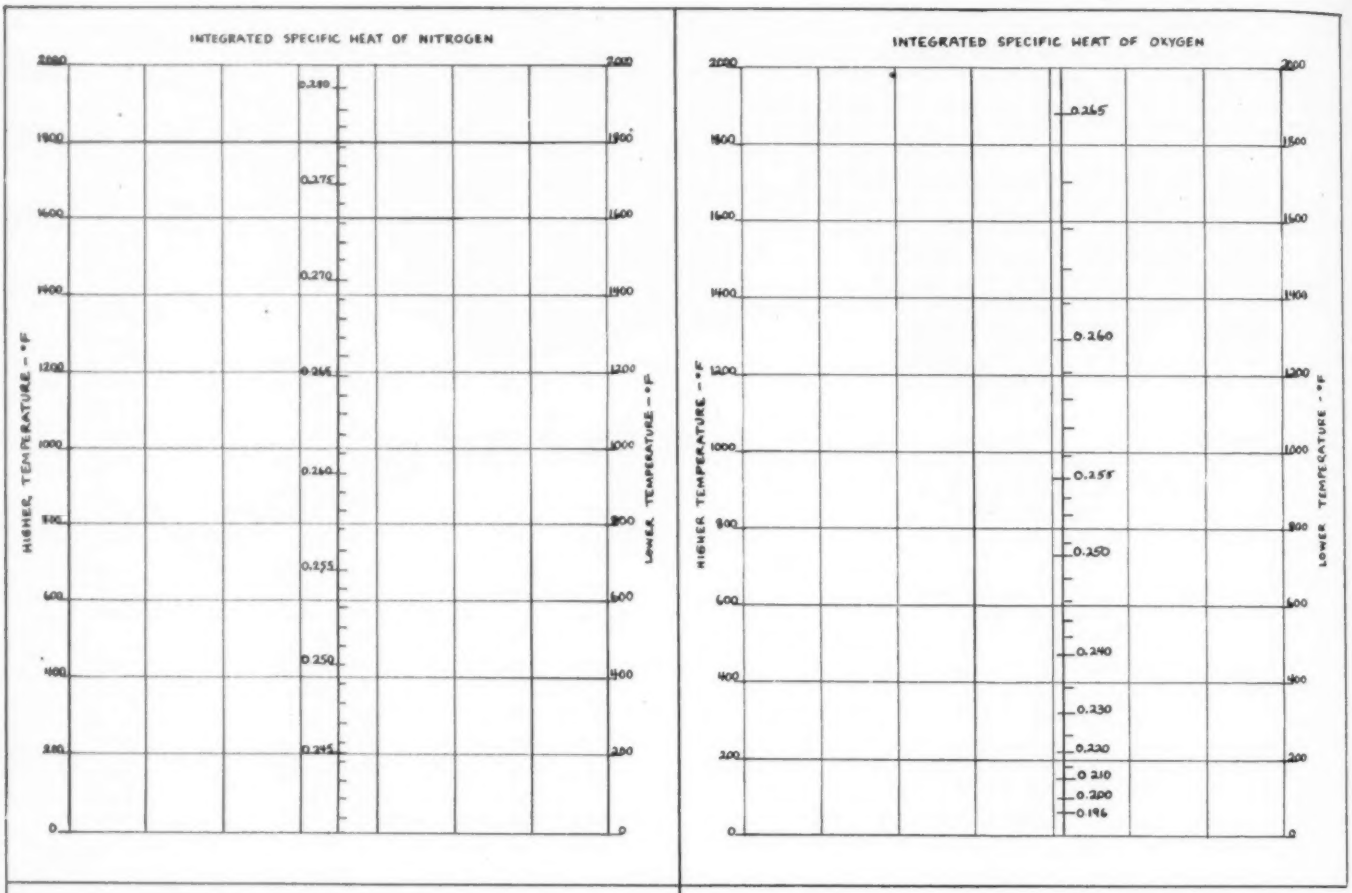
INTEGRATED SPECIFIC HEAT OF NITROGEN
HIGHER TEMPERATURE - °F
LOWER TEMPERATURE - °F
INTEGRATED SPECIFIC HEAT OF OXYGEN
HIGHER TEMPERATURE - °F
LOWER TEMPERATURE - °F
INTEGRATED SPECIFIC HEAT OF AIR
HIGHER TEMPERATURE - °F
LOWER TEMPERATURE - °F

Charts for determination of total heat involved in nitrogen, oxygen, and air

(Continued from page 148)

per cent to 3 per cent, the nomographs are readable within the accuracy of the equations.

The nomograph for water vapor is included as the importance of this constituent in the gases is frequently overlooked. For example, in burning high calcium lime with pulverized coal containing 72.8 per cent carbon, 5.3 per cent hydrogen, 1.4 per cent nitrogen, 8.8 per cent oxygen, and containing 8.1 per cent ash and 3.0 per cent free water, at a fuel ratio of 3.6 to 1, it may be calculated that there will be obtained 0.855 lbs. carbon dioxide, 0.0773 lbs. water, and 1.170 lbs. nitrogen, per pound of dry stone burned. At some point in the kiln the gas temperature is 1650 deg. F., and below this temperature lime cannot be calcined. It is desired to estimate the temperature of the stone at this point. The gas is leaving the kiln at 1000 deg. F. and the stone is entering at 60 deg. F.

By using the nomographs it is found that the gas equivalent to one pound of stone has lost 392 B.t.u. if the water content is considered, but only 365 B.t.u. if the water content is neglected. The former figure used in conjunction with the nomograph for $CaCO_3$ and not considering radiation loss indicates that the stone has been preheated to 1510 deg. F. while the latter figure (neglecting water vapor) indicates a preheat to only 1430 deg. F.

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This film provides better lubrication for your engines—cuts maintenance costs—helps improve performance.

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In automotive Diesel engines: Gulflube H.D.'s full detergency means you avoid high temperature sludge, piston varnish, lacquer, and stuck rings. You get cleaner engines, with a minimum of fuel soot deposits.

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Gulf's New Detergent Motor Oil For Diesel Engines and Gasoline Engines in Extra Heavy-Duty Service.

In Cement, Lime, and Concrete

A.S.T.M. annual meeting in Atlantic City reveals progress in industrial minerals research

AFTER an absence of several years from its most popular annual meeting place, Atlantic City, N. J., the American Society for Testing Materials held one of its best attended meetings there, June 16-20. Many committee activities more or less interrupted by the war were taken up again, and among these are pursuit of further knowledge on concrete, lime, cement and aggregates.

Entrained Air in Concrete

All of one morning's session, with A. T. GOLDBECK, director of engineering and research, National Crushed Stone Association, as chairman, was devoted to papers and discussion on ways to measure the percentage of entrained air in concrete. Contributors were Carl A. Mensel, Portland Cement Association; P. D. Miesenhelder, State Highway Commission of Indiana; John H. Swanberg and T. W. Thomas, Minnesota Department of Highways; C. B. Schweizer, Corps of Engineers, David Pirtz and Alexander Klein, University of California; H. W. Russell, Illinois Division of Highways; W. A. Gordon and H. W. Brewer, U. S. Bureau of Reclamation; J. C. Pearson, Lehigh Portland Cement Co.; J. F. Barbee, Ohio Department of Highways.

We will not attempt to digest the various test methods described or recommended because it is assumed that cement and ready-mixed concrete manufacturers are already familiar with at least some features of the various methods and devices, and primarily producers are more interested in results than in test methods. The very fact that at least three methods are in common use shows that there still exists considerable difference of opinion among testing engineers and that results obtained with the various methods are far from concordant. The methods most used are known as the gravimetric, the volumetric and the pressure methods. The pressure method originally developed and described by W. H. Klein, Lawrence Portland Cement Co. (formerly vice-president, Pennsylvania-Dixie Cement Corp.) and Stanton Walker, engineering and research director, National Sand and Gravel and National Ready Mixed Concrete Associations, appeared to be the most favored and the most reliable test.* The principle of this method has already been described in ROCK PRODUCTS (April, 1946, p. 116).

Mr. Menzel described the only new method, in which a rolling and tumbling cylinder is used. This method was compared with the pressure method, and results were similar. The main point he brought out, of interest to concrete manufacturers and users, was that the entrained air should be between 3 and 6 per cent for best results. Causes of error in all the methods were discussed, and attention was called to one source of error, which might account for slight discrepancies in the pressure method; this is the solubility of air in water. Another source of error is the difference in volume of air at different temperatures.

That the use of air-entrained concrete is growing by leaps and bounds is evident. Mr. Russell in his discussion said that air-entraining cement has been required for all concrete pavements constructed under the supervision of the Illinois Division of Highways in the City of Chicago since 1943, and in August, 1945, the same requirement was extended to apply to all municipalities in the state. He uses the Klein-Walker pressure method for determining the entrained air in concrete, and described some improved laboratory equipment, designs for which were developed by Minnesota State Department of Highways. Among his conclusions were: "The pressure method shows satisfactory performance and a high degree of uniformity of results; and the test may be used in determining yields of concrete."

This latter part of the test should interest producers more directly, and is described by Mr. Russell as follows: "The yield of a batch of concrete may be obtained directly from the air content determined. To do this, it is necessary only to calculate the combined absolute volume of the ingredients in the batch and to increase this absolute volume by the volume of entrained air. This method, since it does not depend upon determining the weight of a known volume of concrete, probably is of greater accuracy than the method now used."

Ready-Mixed Concrete Specifications

Committee C-9 on Concrete Aggregates was concerned chiefly with a new tentative specification for ready-mixed concrete. The original specifications have had a rather checkered career, for it has seemed impossible to satisfy everyone. Published by the Society as Tentative from 1933 to 1935, they were adopted then as Standard, and so published until 1942, being revised in 1938. The specification was further revised in 1941 and reissued as Tentative; revised again in 1942, 1943 and 1944; published again as Standard from 1944 to 1947; and are here again revised and republished as Tentative.

Lack of uniformity in the slump test between different batches of delivered concrete has always been a moot subject. This is covered in the present specification as follows: "When the specified slump is 3 in. or less, the tolerance shall be plus or minus ½ in. When the specified slump is greater than 3 in., the tolerance shall be plus or minus 1 in."

The specification requires that cement and aggregates be batched by weight, and water by volume or weight. Powdered admixtures are measured by weight, and paste or liquid admixtures by weight or volume, within a limit of accuracy of 3 per cent.

The controversial issue of who shall take the responsibility for the quality of the concrete in the absence of specific specifications is provided for by giving the purchaser the option of one of two methods. Alternate No. 1, is when the purchaser assumes responsibility for the design of the mixture, he must then specify (1) the cement content per cu. yd.; (2) sizes of coarse aggregate; (3) maximum allowable water content; (4) slump desired at the point of delivery; (5) when air-entraining cement or an air-entraining admixture is used, specify the maximum and minimum air content of the concrete samples taken at the point of discharge. The concrete manufacturer determines the proportions of fine and coarse aggregates, subject to the approval of the purchaser. Alternate No. 2 applies if the purchaser requires the concrete manufacturer to assume responsibility for the design of the mixture. The purchaser must then specify (1) the minimum allowable compressive strength as determined on samples taken from the transportation unit at the point of discharge; (2) designated size or sizes of coarse aggregate; (3) slump

(Continued on page 156)

*Journal of the American Concrete Institute, June, 1946.

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Both filter sections F and G handle the dust-laden air.
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Main Damper K is closed, small damper M is open for reserve air-flow through filter F, to assist shaker drive H, which is now in operation in removal of dust from bags.
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● In some industrial processes dust control must be continuous —without interruption.

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SLY
INDUSTRIAL DUST CONTROL

A. S. T. M. Meeting

(Continued from page 154)

desired at point of delivery; (4) air entrainment, as under Alternate No. 1. The manufacturer determines the proportions of fine and coarse aggregate as before.

The principal other issue covered in the new Tentative Specification is the delivery of ready-mixed concrete in non-agitating equipment, or in dump trucks. The specification merely says that "central-mixed concrete may be transported in non-agitating equipment only when provision for such method of transportation is made in the contract." When non-agitating equipment is used the body of the truck must be smooth and watertight, with gates that will permit control of the discharge, and the concrete when delivered must be "thoroughly mixed and uniform mass and discharged with a satisfactory degree of uniformity." Slump tests of individual samples taken at approximately one-quarter and three-quarters points of the load during discharge shall not differ by more than 2 in.

The specifications include, for information only, two tables which should prove helpful to ready-mixed concrete manufacturers and purchasers alike. One is a table of water contents suitable for various conditions of exposure, for concrete. The other is a table of compressive strengths of concrete suitable for various conditions of exposure. Both are from the Report of the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete.

Chemically Active Aggregates

After several years of "scare" contributions on the evil effects of using chemically active coarse aggregates with "high alkali" portland cements, W. C. HANNA, California Portland Cement Co., came forward with a suggested cure. He decided that the chemical reaction about which so much has been written and spoken is nothing more than proof of the pozzolanic activity of the aggregate—usually an opaline form of silica. Hence, if some of this pozzolanic coarse aggregate is pulverized and added to the cement, or interground with it, a pozzolanic cement is the result. With a good pozzolanic cement concrete, the lime and other alkalies set free, react with the pozzolana and not only is there no unfavorable reaction with the coarse aggregate, but a better, more watertight concrete results. Like nearly all other good, faithful portland cement men, Mr. Hanna emphasized that the use of pozzolana is not necessary except where unsatisfactory reaction in aggregates is encountered.

Nevertheless, this was quite a concession because the industry, as a whole, has resisted the use of pozzolana cements for many years. The change is all the more remarkable because the Portland Cement Association research laboratory has verified Mr. Hanna's conclusions. In the discusson following Mr. Hanna's paper, there appeared to be some basis for the belief that high alkali cements were not as responsible for the trouble as the aggregates, since an instance was cited of concrete disintegration in Nebraska where sand and gravel were the aggregates and the cement was low in alkalies. Mr. Hanna also concluded that low alkali cements were not a positive cure.

Soft Pieces of Aggregate

D. O. WOOLF, Public Roads Administration, discussed a subject of perennial interest to aggregate producers —how to test for pieces of so-called "soft aggregate." He found that a commercial device based on throwing the particles out from a revolving horizontal disk against inside cylindrical breaker or liner plates gave very good results, but the device is too heavy and bulky for transporting as a testing machine. Their search for a simple field method led back to the time-honored scratch test for the hardness of minerals. A yellow brass rod was developed with a Rockwell hardness of B69 which will not scratch good limestone, or leave a streak on hard stone. In a small bar the size of a lead (1/16 in.) in an ordinary pocket pencil, it will give a good idea of the relative "softness" of rocks near the border line. Mr. Woolf emphasized that a specification limit on "soft" stone should apply to the percentage of soft pieces only, and not to other kinds of unsound pieces.

Cement-Blends

Committee C-1 on Cement reported practically all of its subcommittees active. The place of C. E. WUERPEL, chairman of the Sponsoring Committee on Portland Cement, was given to R. R. LITEHISER, Ohio State Highway Department. This is probably the most important subcommittee and the chairmanship has been ably filled by Mr. Wuerpel, U. S. War Department, who is in South America on leave of absence from his Army Engineer materials testing job. The Tentative Specification for Air-Entraining Portland Cement was revised by deleting the requirement of "0.7 to 2.0" for the ratio of Al_2O_3 to Fe_2O_3 for Type IIA and in the Standard Specification Types II and IV cement. The Tentative Specification for Portland Blast-Furnace Slag Cement was amended to permit intergrinding TDA with the clinker and slag. Incidentally, the New York State Highway Department is using a cement of this kind as a substitute for natural cement, as a required blend for pavement concrete.

A. G. TIMMS, W. E. GRIEB and GEORGE WERNER, Public Roads Administration, presented a paper on "The Effect of Blends of Natural and Portland Cement on the Properties of Concrete," which, with the discussion following, tended to explode some of the theories to account for the beneficial effects sometimes resulting. It has frequently been said that the good results in resistance to scaling and frost action in concrete pavements were due chiefly to the fact that the natural cements had air-entraining properties, either inadvertently from the method of manufacture, or by design from the introduction of tallow or other grease.

The authors of the paper found that blends with non-air-entraining natural cements gave better strength tests than those with air-entrainment; that there was no outstanding difference in shrinkage, but there was better freezing and thawing resistance with air-entrainment. This last conclusion was disputed by IRA PAUL, New York State Highway Department, who said the scaling of concrete pavements made with blended portland and natural cements was reduced even with no air-entrainment, or not more than about 1 per cent. He attributed the superior results from the use of blended cements to the grease or oil which, he said, reacts with the alkali in the cements to form waterproofing compounds.

Lime Properties

H. R. STALEY and S. H. GREENFELD, Massachusetts Institute of Technology, prepared a paper "Surface Areas of High-Calcium Quicklimes and Hydrates," which was read in their absence by W. C. Voss, chairman of Committee C-7 on Lime. The following conclusion is most interesting because it is contrary to hitherto generally accepted theories: "When slaked with excess water, lime hydrates produced from 'hard-burned' quicklimes had higher surface areas than those made from 'soft-burned' quicklimes. The surface area of the lime hydrates made from either quicklime increased with slight excess water of slaking, but with increasing amounts of excess water the surface areas dropped rapidly to constant values."

The laboratory work included determination of the surface areas and estimated pore sizes of the limestone and quicklimes produced by various calcining conditions; also the effect of salt (NaCl) during calcination upon the surface area of hydrated lime. The authors state, "Sodium chloride has apparently acted as a fluxing material, increasing the mobility of the calcium and oxygen atoms or ions sufficiently to permit them to pack more tightly and more rapidly than in its absence." Hence, lime burned with salt in the flame is harder to hydrate, but is not entirely like "hard-burned" lime, as evidenced by its wet-slaking characteristics; these are much more like the "soft-burned" lime.

(Continued on page 164)

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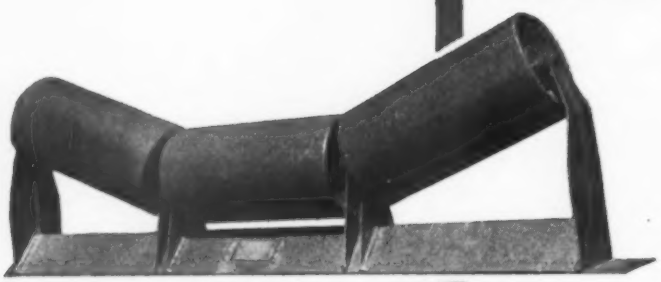

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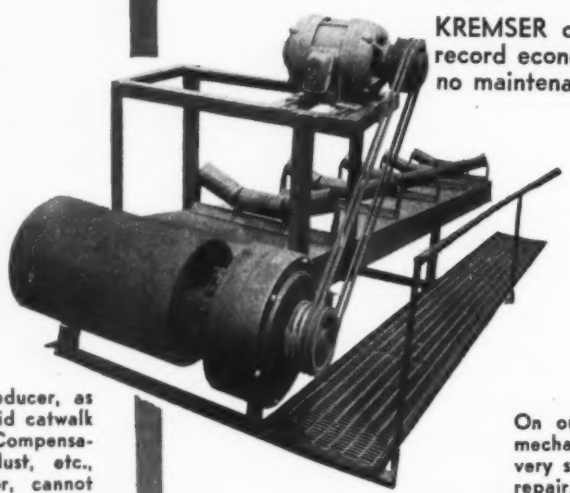
These units incorporate the latest improvements, and their extra sturdy and simplified construction insures continuous trouble-free serviceability under the hardest working conditions in quarry, pit or mine.

KREMSER conveyor units operate with record economy, and require practically no maintenance.



Featuring enclosed speed reducer, as shown in picture; also non-skid catwalk —approved by most State Compensation Boards. Snow, ice, dust, etc., which collect on solid floor, cannot cause slippage on this type of catwalk. Head arrangement exactly as shown on picture opposite.

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270 to 304 Barrels
73 Cu. Yds.
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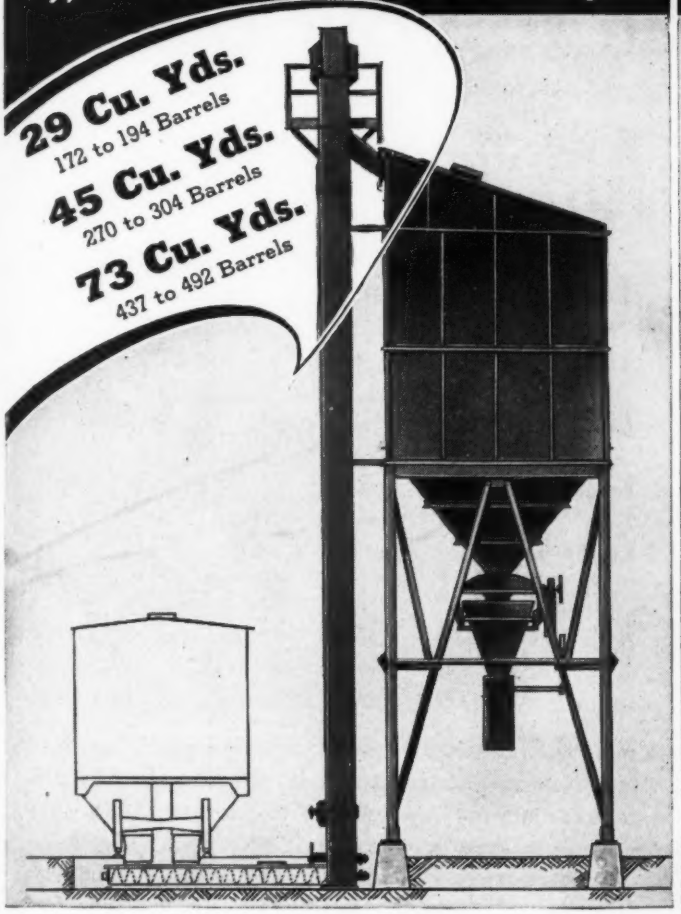

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667 to 750 Barrels
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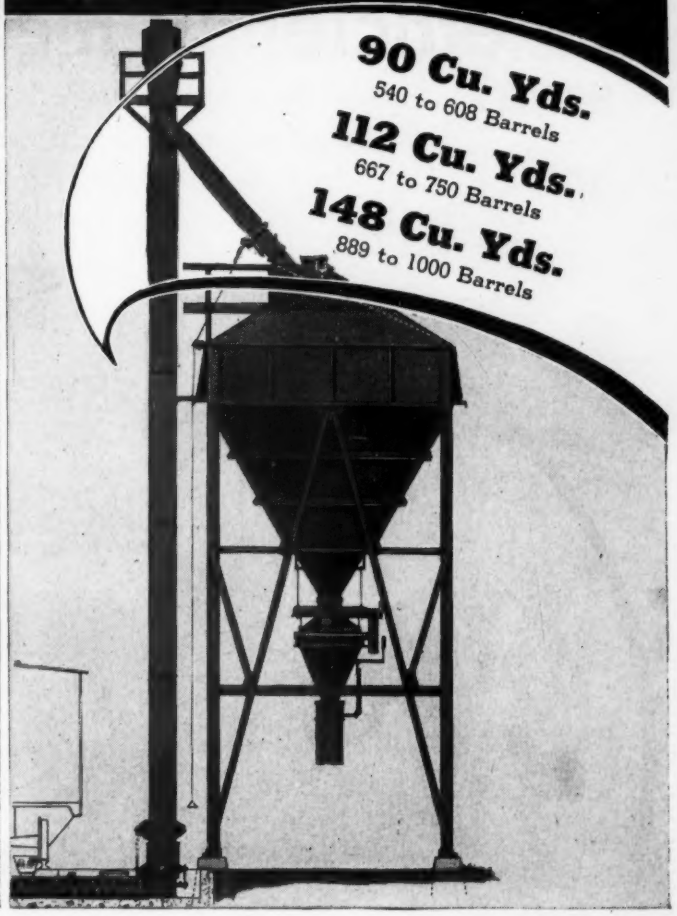

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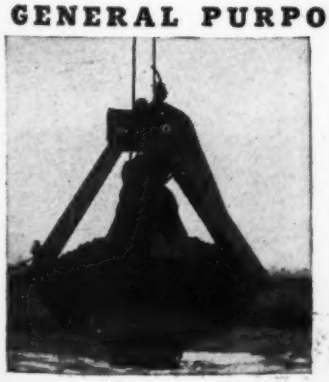

One of 10 Erie types of buckets available in 11 standard sizes from ¼ to 2½ Cu. Yard, incorporating the block and tackle plus leverage principles with selective reeving for speed and power. Steel castings and forgings with welded steel plate construction are combined in a low-head design for greatest digging durability. Write for booklet on general purpose buckets.

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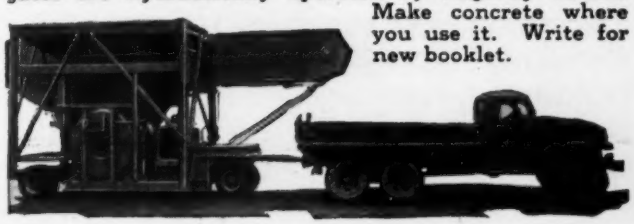

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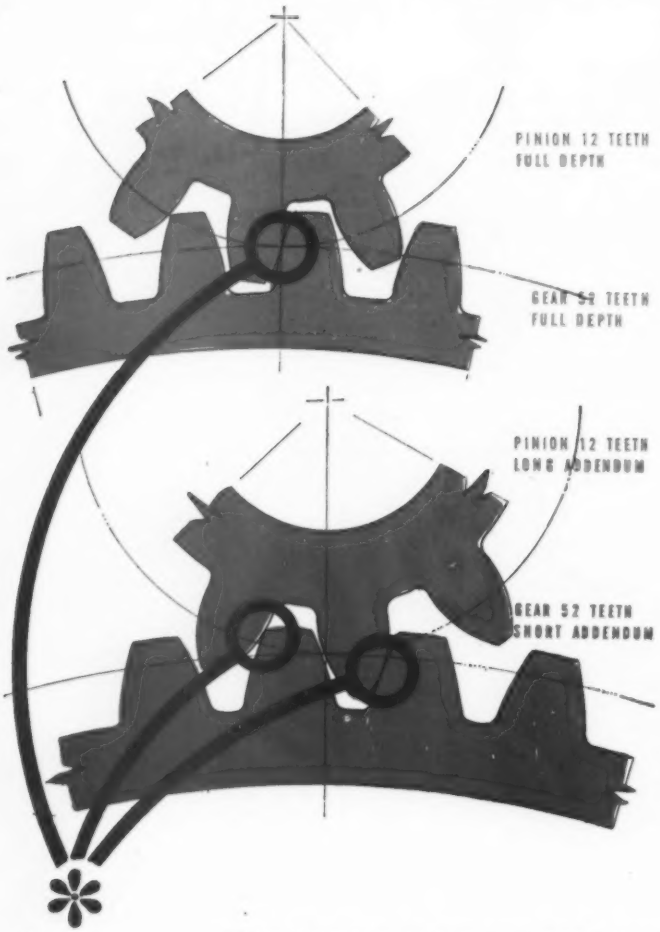

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Longer life from pinions.

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Note that 20 degree gears come in contact sooner and remain in contact longer insuring greater surface contact between gears and pinions. Notice also the wider tooth base on both gear and pinion.

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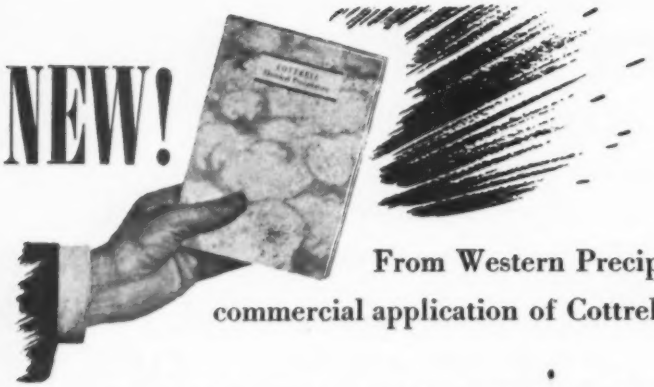


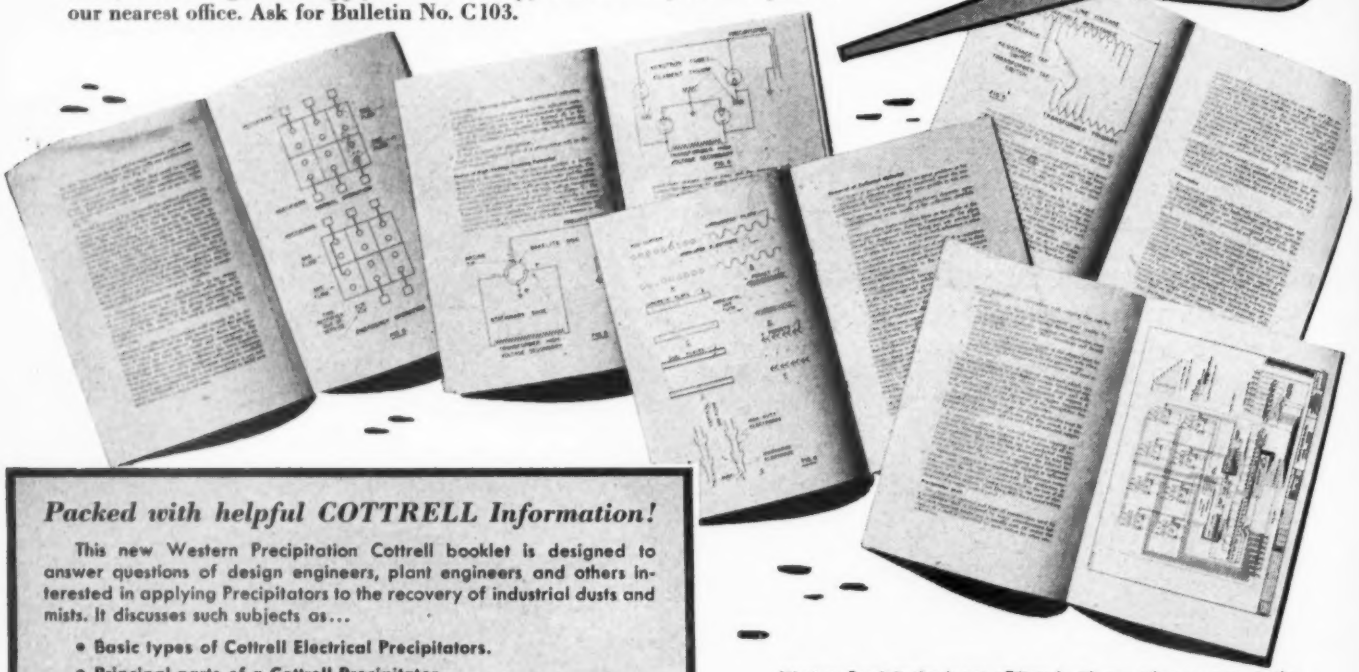
From Western Precipitation—the organization that pioneered the commercial application of Cottrell Precipitation...

IF YOU ARE ENGAGED in any phase of industry where the recovery of dusts, fumes, fly ash, mists, fogs or other suspensions from gases is a problem, you will find this new booklet on the COTTRELL Electrical Precipitator helpful and informative.

Western Precipitation pioneered and installed the first commercial application of the well-known COTTRELL Electric Precipitator—Dr. Cottrell, the inventor, being a member of the company. And for more than 38 years Western Precipitation has consistently led in developing new COTTRELL advancements and techniques for recovering suspensions from gases, both wet and dry.

This new 28 page booklet summarizes many of the basic facts you should know about modern COTTRELL Precipitators—the various types available, how they operate, principal types of electrode systems and rectifiers, shell constructions, etc. As long as the supply lasts, a free copy will be sent you on request to our nearest office. Ask for Bulletin No. C103.

28 PAGES
of helpful facts to know about
COTTRELL ELECTRICAL PRECIPITATORS



Packed with helpful COTTRELL Information!

This new Western Precipitation Cottrell booklet is designed to answer questions of design engineers, plant engineers and others interested in applying Precipitators to the recovery of industrial dusts and mists. It discusses such subjects as...

- Basic types of Cottrell Electrical Precipitators.
- Principal parts of a Cottrell Precipitator.
- Mechanical and Electronic Rectifiers.
- Various types of Collecting Electrodes (rod curtains, corrugated plates, dual plates, pocket electrodes, etc.).
- Removal of Collected Material.
- Factors in Shell Construction (steel, concrete, brick, etc.).
- Operating Efficiencies and the Effect of Various Factors on Performance.

...and many other basic Cottrell facts. Write for your free copy of Bulletin C103 today while supplies are adequate!

Western Precipitation is not affiliated with any other company in the field of electrical precipitation except its wholly owned subsidiaries, International Precipitation Corporation and the Precipitation Company of Canada, Ltd. Whether you are now contemplating the installation of a Cottrell Electrical Precipitator, or may be interested in such an installation at a future date, we can and will serve you in *any part* of the United States or other countries.

NOW SELLING

COTTRELL Precipitators
MULTICLONE Collectors
TURBULAIRE Spray Dryers

...in all parts of the U. S. A. and foreign countries.

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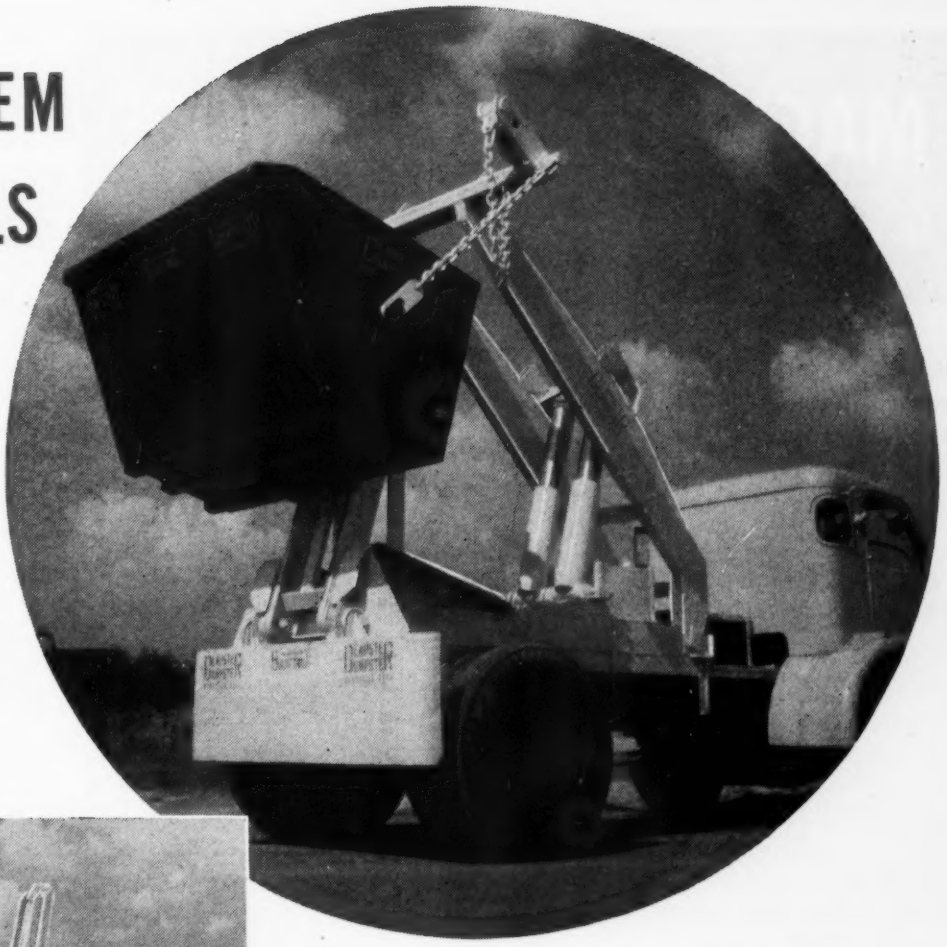

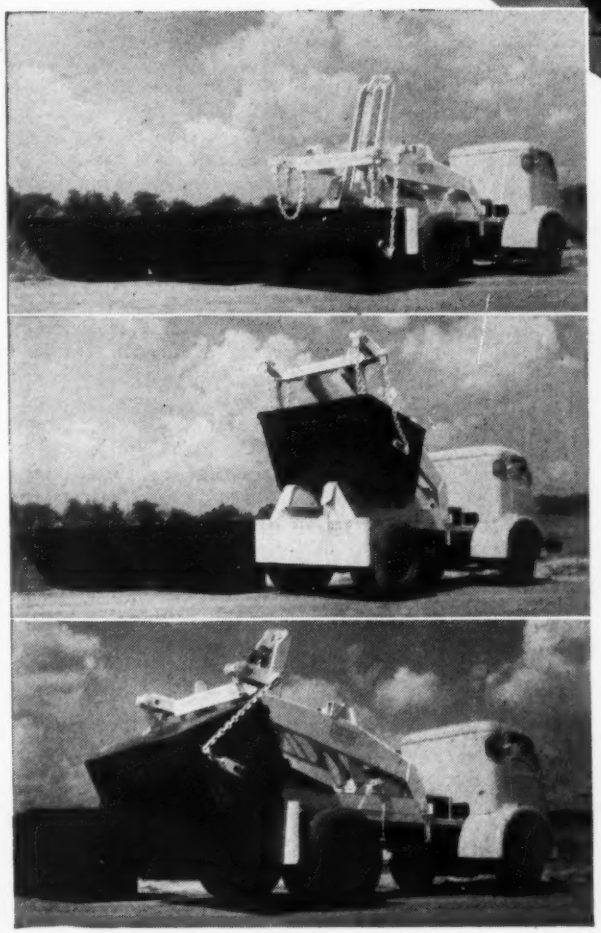

It makes no difference what materials you handle, profits depend on how fast . . . how efficiently you get the material out. Whether you handle rock, gravel, sand, or clay, the Dempster-Dumpster System does the job faster, more efficiently, and at tremendous savings . . . that's why it's winning the acclaim of operators everywhere.

One Dempster-Dumpster truck hoisting unit serves any number of bodies needed to meet your requirements. Here's how it works. Bodies are placed at convenient loading points. The hoisting unit picks up each body, in turn, as it is loaded . . . hauls it, dumps it and returns it for reloading. Truck hoisting unit is constantly on the move; no waiting for trucks; wasted man-power is eliminated; operating expense of rolling stock is cut to a minimum by this endless cycle of loading, hauling and dumping.

Pictured at left are three stages of operation. Above; 6 cu. yd. Tilt type body on ground. Center; Hoisting unit lifts body into carrying position. Below; Dumping Action. All operations hydraulically controlled from driver's cab. Write today for complete information on how the Dempster-Dumpster can help you cut materials handling costs and increase production.

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is correct for Rock Product operations

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A useful wire rope handbook and buyers' guide will be sent to you on request. Ask your Macwhyte distributor or write Macwhyte Company for Catalog G-15.

NO. 903

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LET'S LOOK AT THE RECORD!

1000 PYRASTEEL KILN ENDS

have been installed in cement kilns over a period of 14 years, without one failure recorded. This is definite proof of the ability of PYRASTEEL kiln ends to avoid costly burn-outs, and give years of continuous service.

In other high-temperature applications, PYRASTEEL has no equal in assuring uninterrupted, high-economy operation when used for making conveyor screws, drag chains, feed pipes and clinker coolers.

Showing discharge end of cement kiln fitted with PYRASTEEL Segmental Kiln Ends.

Unit segments are easy to install or replace.

Write for PYRASTEEL Bulletin

CHICAGO STEEL FOUNDRY COMPANY
PYRASTEEL for high temperatures
KEDZIE AVE & 37TH ST.
CHICAGO 32, ILL.
Makers of Alloy Steel for 35 Years
EVANSTEEL for strength

A.S.T. Meeting

(Continued from page 156)

The authors state that: "Although in commercial practice and in the laboratory it has been found that hydrates made by dry hydration from 'soft-burned' quicklimes have higher surface areas than those made from 'hard-burned' quicklimes, it is readily seen from the data (in this paper) that the reverse is the case when wet hydration is used. The hydrates made from 'hard-burnd' quicklimes by wet hydration had surface areas approximately double those of commercial dry hydrates; those made from 'soft-burned' quicklime, by wet hydration had somewhat lower surface areas than commercial dry hydrates."

The wet hydration meant water 4, 8, 12, 16, 20 and 24 times the minimum requirement for complete hydration. Maximum surface areas were obtained when about twice the minimum water requirement was used. After that the surface areas decreased with excess of water. The temperature of the water also had an important influence on the surface areas. The maximum surface areas occurred when the temperature was about 20 deg. C. or below.

The authors conclude their paper with the statement that the investigation is continuing—presumably it is part of the fundamental research on lime for the National Lime Association.

Committee C-7 on Lime listened to subcommittee reports. The subject of most general interest is the progress of Subcommittee III, which has been working on a master specification for the chemical lime users. The subcommittee has now been instructed to consider the formulation of tentative specifications for chemical lime used in industries whose requirements are not now covered by specifications. The subcommittee will also questionnaire all user industries to find out if standing specifications are satisfactory.

Incidentally, W. C. Voss, head of the Department of Building Engineering and Construction, Massachusetts Institute of Technology, and chairman of Committee C-7, was chosen this year to give the Edgar Marburg Lecture — a distinguished honor. Prof. Voss' subject was "Engineering Laminates."

Cement Trends

(Continued from page 121)

tors, in closed circuit with our clinker grinding tube mills, with the Norblo device for cooling cement with air. This has been found quite effective so far although we wish to run through one hot weather season before a final estimate of its worth.

"We are about to replace most of the screws and elevators in our clinker grinding department, including transportation to storage, with Fuller-Kinyon pumps. This was done some years ago in our raw grinding department.

(Continued on page 166)

"PERFORMANCE has been PERFECT"

Pioneer 20" x 36" Jaw Crusher Model 150 P.R.L.-2036 and Pioneer 22" x 40" Roll Crusher secondary unit Model 2405 powered by a 4-71 and a 6-71 GM Diesel engine respectively.

It takes a lot of power to crush 1000 tons of large rock a day and turn it into sand and gravel.

That's why the National Truck Service of Asheville, N. C., chose GM Diesels when they set up this rock-crushing plant. Tough GM Diesel power gives them production up to 170 tons per hour at a fuel cost of less than 10¢ per ton.

Because GM Diesels are 2-cycle engines, they provide power at every piston downstroke. They are built to "take it" on tough jobs such as this. They are cleanly designed and "easier to get at" should servicing become necessary. They are compact and easier to install.

All this makes the GM Diesel ideal for all kinds of construction work. If you have a tough, demanding construction job where dependable, low-cost power is a MUST—better get all the facts about these hard-working, husky GM Diesels.

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DETROIT 23, MICH. • { SINGLE ENGINES . . Up to 200 H. P. / MULTIPLE UNITS . . Up to 800 H. P.

GENERAL MOTORS

DIESEL BRAWN WITHOUT THE BULK

GM GENERAL MOTORS DIESEL POWER

PLAT-Os STAND UP!

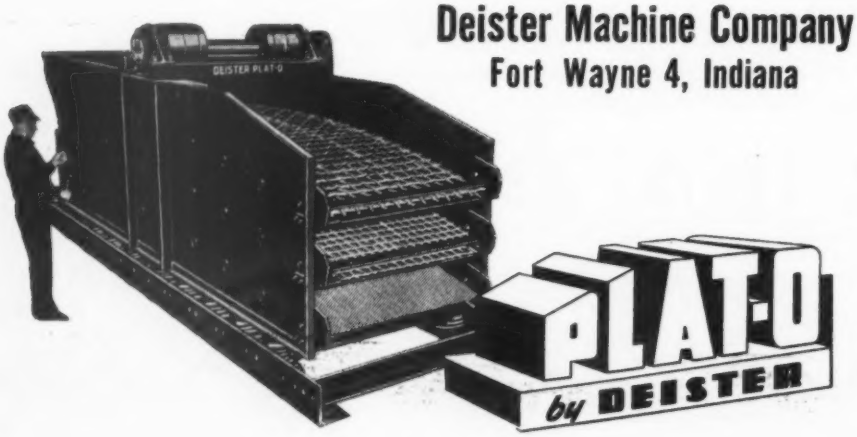
Mr. Lewis

"If I were going to build my own gravel plant, I would have nothing but Plat-O Vibrating Screens in it," says Arthur Lewis who watched 17-years of outstanding performance by a Deister Plat-O, and who installed two other Plat-O Screens and a Deister Multirap Vibrator in the plant he manages.

Mr. Lewis is superintendent for the St. Louis Material & Supply Company, Pacific, Mo., which has operated the plant pictured above since 1917. The first 4' x 8' double-deck Plat-O Vibrating Screen in 1930. Pleased with its rugged efficiency and the ease with which screen cloth can be changed, Mr. Lewis added two similar Plat-Os, starting in 1937.

With his original Plat-O "still going strong after 17 years of rugged, profitable service," Mr. Lewis will gladly recommend Deister's heavy-duty, all-welded equipment to anyone. To learn how Plat-Os can improve your operations, write for details.

Below: the 17-year-old Plat-O is shown at the left of this battery of three Plat-O Vibrating Screens.



Deister Machine Company
Fort Wayne 4, Indiana

Cement Trends

(Continued from page 164)

"We are going to complete replacement of our old Bates packing machines, some of which are still installed on the floor, with elevated Bates machines from which woven wire belts will carry the loaded sacks and deliver them, we hope, to the cars much cleaner than they are now. One of our packing machines has been of this type for some years.

"We contemplate building a good deal more storage for finished cements but this work is not in progress as yet."

A far Western plant (wet process):

"Our new construction program is now practically completed and our new kiln and related equipment is now in operation.

"The following outline will give you information on what the new installations include:

"1. A new F. L. Smidth kiln 8 ft. x 9 ft. x 8 ft. x 287 ft. has been installed. This kiln is equipped with Unax coolers. The most modern oil burning equipment has been installed, including pre-heating equipment for fuel oil, etc.

"2. A Cottrell electric precipitator has been installed for recovery of dust. This was purchased from and installed under the supervision of the Western Precipitation Corp., Los Angeles, Calif.

"3. A new hammermill crusher has been added to our crushing department to provide smaller sized material to our raw grinding mills.

"4. An additional new raw grinding mill and building to house it has been installed. This mill is driven by an 800-hp. General Electric motor.

"5. Two new slurry basins, 36 ft. in diameter by 30 ft. in height, have been constructed.

"6. An additional new finish grinding mill driven by a 900-hp. General Electric motor has been installed.

"7. Our electrical department has been expanded and increased in capacity to carry the load of the new unit. This expansion has included additional transformers, a complete re-wiring of the plant, numerous new motors, etc.

"The capacity of our former Vulcan kiln is being increased through the installation of chains and other improvements.

"The total capacity of finished cement from our plant has been increased from about 1150 bbl. per day to approximately 3000 bbl. per day.

"The entire new construction set forth above has cost approximately $1,200,000."

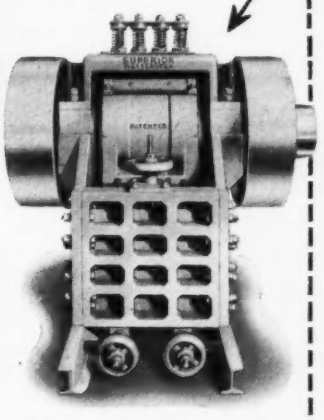
A Midwestern mill (wet process):

"We are now doing engineering work on extensive remodernization of our plant which will include major pieces of new equipment as follows:

"Kilns—We will install two kilns, 11 ft. 3 in. in diameter by 450 ft. in length. These kilns will be wet process, and coal fired."

crushes more rock! costs less to run!

Superior-Wettlaufer
FLOATING PITMAN
Rock Crusher



Gives faster operation with lower power and upkeep costs because there's less vibration with *weight of pitman* and *jaw removed from shaft!*

10″ x 24″ size puts out approx. 15-18 tons per hour for ¾″ opening up to 30-38 tons for 2″ opening. Actual power requirements *less than 15 h.p.!*

Spring-suspended, roller-bearing *floating pitman!* Roller-bearing pitman shaft! Reversible manganese steel jaws. Labyrinth oil seals. Easy adjustments on the job.

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SUPERIOR, WISCONSIN
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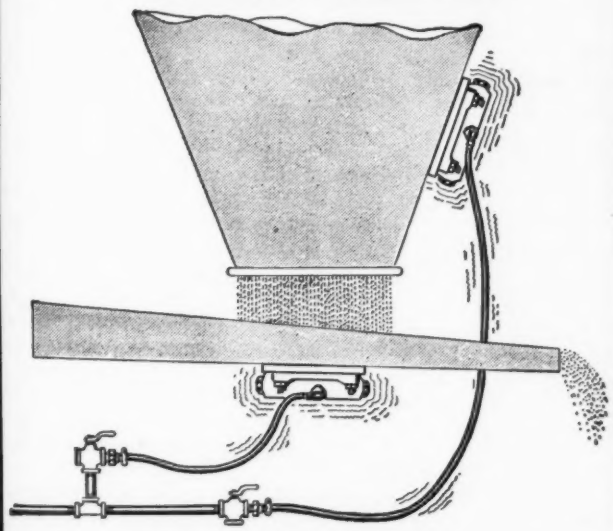
"BRANFORD"
PNEUMATIC VIBRATORS



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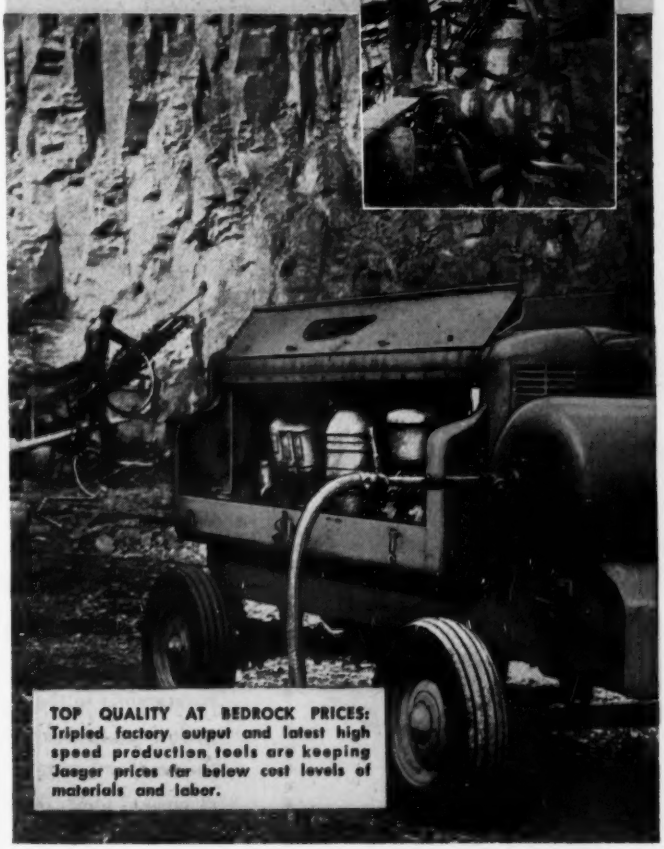
"AIR PLUS" Compressors travel with the tools — wherever you want to work



TOP QUALITY AT BEDROCK PRICES: Tripled factory output and latest high speed production tools are keeping Jaeger prices far below cost levels of materials and labor.

The modern portable compressor, fully developed by Jaeger, has proved a flexible and efficient source of power for quarry work. Self-contained units, able to travel wherever a truck can go, they move with the job and work only as needed. Precision built and powered with heavy duty gasoline or diesel engines of the latest type, they require far less fuel and upkeep than old-type portables, deliver cooler, drier air, will provide up to 600 cu. ft. of air per minute for 8 hours of steady drilling, every working day.

Send for name of your nearest Jaeger air station and Catalog JC-5, the up-to-date buyer's guide.

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The safety factors built into Naylor light-weight pipe have made it outstanding in the mining field. The exclusive Lockseam Spiralweld provides the reason. Acting as a continuous expansion joint, this structure absorbs shock loads, vibration, expansion and contraction . . . insuring closer conformity to topographical conditions without any sacrifice of strength. For high pressure hydraulic lines, high and low pressure air lines, de-watering and drainage lines, ventilating lines, water supply lines and sludge lines, it will pay you to specify Naylor light-weight pipe.

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Naylor

NAYLOR PIPE COMPANY
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New York Office: 350 Madison Avenue • New York 17, N. Y.

Kiln Insulation

(Continued from page 147)

(d) Full depth blocks for 21-ft. circumferential insulating spacing.

(e) 6-in. blocks, 5 in. and 6 in. wide, for effecting closures above insulation.

(f) Full depth blocks, 5 in. and 6 in. wide for effecting closures above insulation.

(g) Full depth anchor blocks, 5 in. and 6 in. wide, for effecting closures above insulation.

(4) In the insulated intermediate zone where a super duty clay brick is often used, the following type of liners will be required:

(a) Full depth anchor blocks.

(b) 6-in. full blocks above insulation.

(c) 6-in. half blocks above insulation.

(d) Full depth blocks for 21-ft. circumferential insulation spacing.

(e) Full depth 5-in. and 6-in. widths for effecting closures above insulation.

(f) 6-in. blocks, 5-in. and 6-in. widths, for effecting closures above insulation.

(g) Full depth anchor blocks, 5-in. and 6-in. widths, for effecting closures above insulation.

(5) If the hot zone is insulated, high duty blocks will be required in the following breakdown:

(a) Full depth anchor blocks.

(b) 7½-in. full blocks above insulation.

(c) 7½-in. half blocks above insulation.

(d) Full depth blocks for 21-ft. circumferential insulation spacing.

(e) 7½-in. blocks, 5-in. and 6-in. widths for effecting closures above insulation.

(f) Full depth, 5-in. and 6-in. widths for effecting closures above insulation.

(g) Full depth anchor blocks of 5-in. and 6-in. widths for effecting closures above insulation.

(6) Then there are usually 5 or 6 ft. of super duty full depth fire clay blocks (uninsulated) immediately preceding the discharge end of the kiln.

(7) Finally, there is usually a special shape nose block at the extremity of the kiln.

(8) It is possible that only 2 in. of insulation would be used behind the hot end lining, whereas 2½ in. may be used in the intermediate and cold zone backing.

Note: The use of insulation in the firing end of the kiln is predicated on: 1. Temperature; 2. Flame control; 3. Coating forming character of the product; and 4. Type of refractory.

Closing Comment

One frequently hears the statement, "Well, as they renew the lining they do not replace the insulation." Unfortunately, I know this to be true and offer the following reasons:

(1) The demand for rotary kiln products has through recent years,

been so heavy that from the time the kiln goes out of production until it is again ready to fire, there is a constant struggle against time. So much must be done that only bare essentials receive attention. The operators can lay liners against the shell quite fast under good organization, but to place insulation in accordance with the treatment prescribed in this article requires time and great care. They do not feel that they can spare either. They are willing to overlook the benefits derived from insulation for the time being.

As production costs begin to play a more important part in the overall picture again, the chances are that time and skill will be found to allow for the proper placement of insulation.

(2) Possibly the critic is an operator who did not exercise the prescribed care in the original placement of his insulations with the result that he lost his lining prematurely. With this in mind, his thought is "Why take another chance which may result in a further failure?" To this operator, we suggest a new installation under recommended placement procedure.

(3) Other poor operating practices which were responsible for a general condition of inefficiency. Under such conditions, it is not to be expected that insulation is a miracle worker which can offset a multiplicity of poor operating technique.

To the operator who has had unsatisfactory results from his attempt at insulation, I remind him that his first brick lining probably fell out too, but through necessity he learned how to hold it in place. It is equally important that he learn how to benefit to the maximum through insulation.

To the operator who has not yet decided to insulate his kiln, I suggest he approach the matter very carefully and then proceed advisedly.

I believe insulation of rotary kilns to be right in principle and from experience, I am certain it is right practically.

Mississippi River Flood Halts Sand Production

CAPE GIRARDEAU SAND CO. was forced to shut down for 15 days due to the high stage of the Mississippi river. The forced closing held up a number of construction projects in the area. Cape Girardeau is now pumping 600 to 900 tons per day in an attempt to replenish the supply.

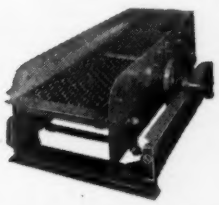
Three Partnerships Incorporate

MOLO SAND AND GRAVEL CO., Linehan and Molo, Inc., coal, coke and fuel oil sales firm; and Molo Oil Co., all of Dubuque, Ia., have each been incorporated with Bart L. Molo as president and treasurer of the three corporations and Harold E. Molo as vice-president and secretary.

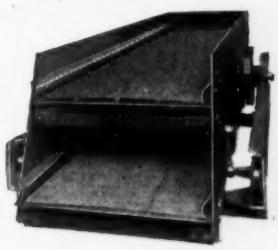
Stumped !

. . . with a TOUGH screening job?

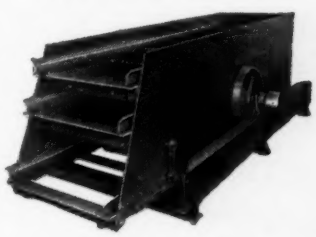
Get a SECO Vibrating Screen



SINGLE DECK



DOUBLE DECK



TRIPLE DECK

Here are two good reasons why we think your particular screening problem can be solved by Seco.

1 Every Seco vibrating screen has a true circular motion under all screening conditions. This is due to Seco's patented equalizer assembly. Bobbing and weaving are impossible . . . and even fine and sticky materials may be screened with a minimum of blinding . . . with a Seco auxiliary vibrator.

2 Seco builds over 200 models to meet practically every type of screening requirement. Right now, thousands of Seco vibrating screens are delivering dependable, trouble-free service from coast to coast. Seco engineers invite you to put your screening problem in their expert hands. Write for "A Guide to Better Screening." Dept. B.

Patented Auxiliary Vibrator. May be attached to any Seco screen to enable efficient screening of damp, sticky materials.

TRUE CIRCULAR MOTION VIBRATING SCREENS

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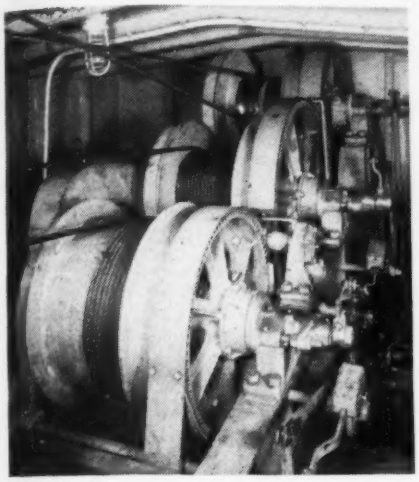
write for a CARLYLE catalog
featuring everything rubber for industrial requirements

FOR DETAILED LISTINGS SEE THE CARLYLE AD ON PAGE 228

Cement Distributing Plants

(Continued from page 131)

push buttons at his station to control all equipment, the electrical system being interlocked so that the machine may not be operated unless the dust arrestor, screw conveyors, screen and



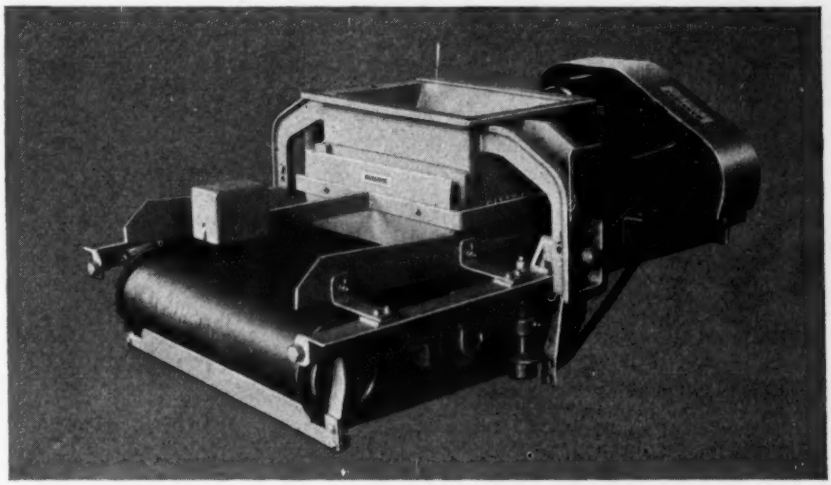
Three-drum hoist for scraper operation on self-unloading barge

other related equipment are first in operation. Sacked cement is loaded out by means of reversible (to either railroad siding) woven-wire Link-Belt conveyors, of which there are three in a single line, so that cement from either machine can be loaded out to either siding. Weight checks are made on Fairbanks scales. Compressed air at 40 p.s.i. is available where needed to facilitate flow out of cement from the silo hopper bottoms and at the valves for loading out bulk cement. Masonry and air-entraining cements are stored in the center row of silos and loaded out by packing machine No. 2.

Missouri Portland Cement Co.'s engineering department supervised the design and construction of the terminal. L. A. Wagner is general superintendent of the company; J. L. Land

Showing types of valves used in cement lines to silos

GRINDING MILL ACCESSORIES



HARDINGE Constant-Weight Feeders Feed by WEIGHT... not Volume

The revolutionary Hardinge Constant-Weight Feeder regulates the flow of materials at a constant-weight rate rather than a constant-volume rate. It automatically compensates for variations in specific gravity of crushed material and irregularity of flow due to moisture-sluggish fines. Can be arranged for weigh-recording also.* Bulletin 33-D.

HARDINGE "Electric Ear"* Robot Engineer for Grinding Mills

A perfect combination for accurate grinding control is a Hardinge "Electric Ear"* controlling a Hardinge Constant-Weight Feeder. The "Electric Ear"* is the only device of its kind which regulates the feed rate of a grinding mill by "listening" to the sound of grinding. Bulletin 42.

*** Reg. U. S. Patent Office.**

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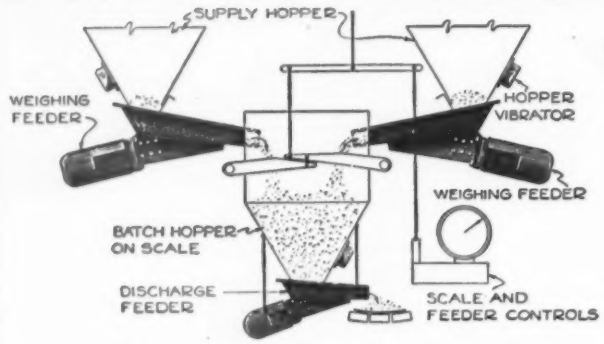
"Automatic"
BATCH WEIGHING



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CONTROL
SELECTIVITY

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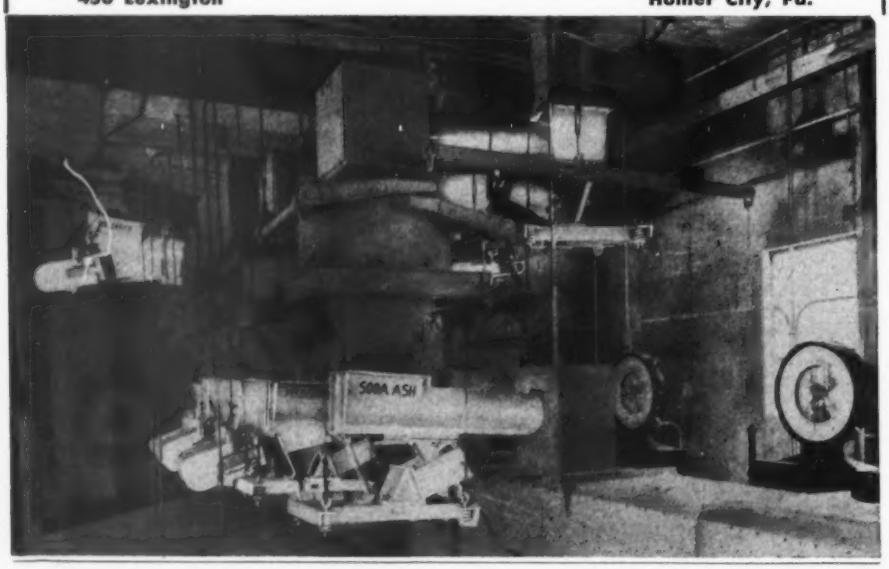

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CAPACITIES: 1 TO 50 TONS PER HOUR
FINENESSES: 20 TO 350 MESH

BRADLEY PULVERIZER CO.

ALLENTOWN, PENNA.

is superintendent of the Memphis operations including the company's sand and gravel plant; and W. B. Harper is foreman of the new terminal. John B. Woodward is chief engineer, and W. C. Mueller of the St. Louis engineering department served as project engineer during construction.

Aluminum to Cement

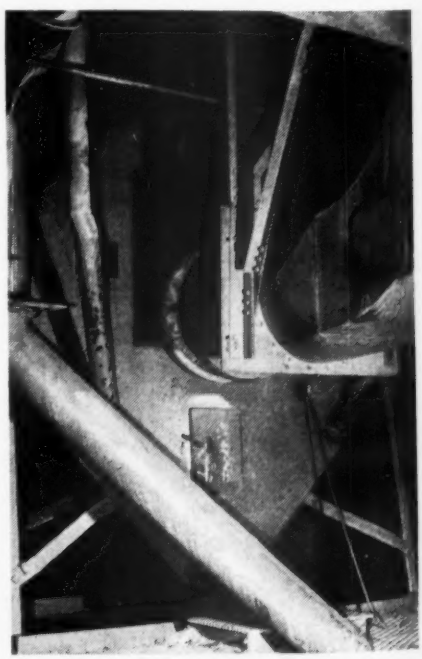
(Continued from page 141)

a shell washing plant when lime manufacture is to start. Coarse shell will be burned into chemical lime and the smaller sizes will be raw materials for cement manufacture.

The existing stone grinding mill was ideally suited for the purpose of grinding cement raw materials, having four 7- x 40-ft. Traylor 2-compartment tube mills driven by 750-hp. synchronous motors, but clay handling and processing equipment had to be installed. A clay wash mill was installed as indicated on the sketch and one of the four "red mud" tanks was set aside for clay slip. Shell is pulverized, with 38 per cent moisture, in two mills and the blend of clay slip and the product of the two tube mills, proportioned by ferris wheel feeders, is ground with a consistency of 43 per cent, through the third mill. Fineness of grind, in open circuit, is 85 per cent minus 200-mesh.

One of the "red mud" tanks is set aside for high lime slurry, another for low lime and the fourth, and two of the four kiln feed tanks, are for correction of the mix. Total mixing tank capacity is 6000 bbl., kiln feed tank capacity is 3000 bbl.; and the total for high lime slurry, low lime slurry and clay slip combined is 4500 bbl.

Each of the kilns is insulated to within 70 ft. of the extreme hot end and is lined with magnesite block in the burning zone, 70 per cent alumina in the calcining zone and 40 per cent



Discharge end of one of the clinker coolers

Showing skip type ball loader for one of the 8- x 16-ft., two-compartment clinker mills

alumina through the evaporation and drying zones. They are gas-fired under induced draft, individual B & W direct-firing unit mills being inoperative. The coolers are operated under pressure and individual draft fans at the back ends of the kiln apply suction through the dust collectors. Firing is through Cheesman luminous double-tube burners. Clinker discharges from the kilns to a Peck carrier at 250 deg. F. and the back end temperature of the kilns is 800 deg. F.

Instrumentation is provided for draft regulation, back end temperature, hood draft, pressure of the air into the kilns, clinker discharge temperature and gas flow.

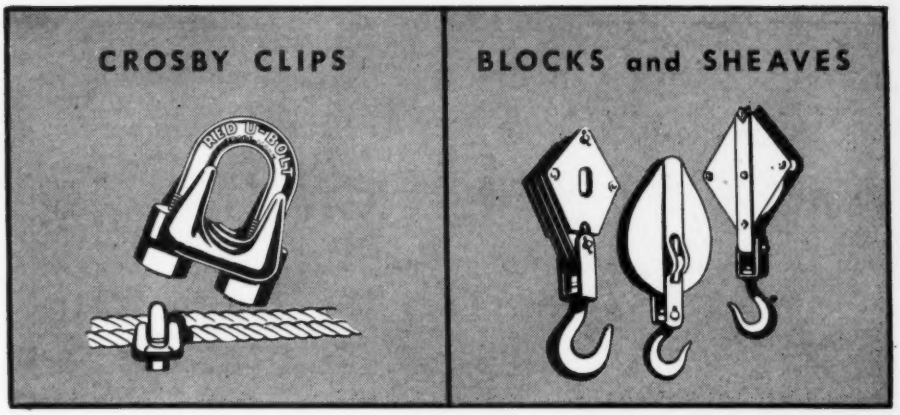
Colton-Lang evaporators, one for each kiln are being by-passed at present, although trial runs have indicated that the moisture in the slurry as fed through the recuperators may be reduced to 35 per cent, with attainment of exit gas temperatures as low as 300 deg. F. The recuperators (see illustration) receive slurry feed through a series of ports and, through action of a beater shaft, convert the slurry into a spray through which the kiln exhaust gases are passed.

Dust Collectors

Exit gases from the kilns are scrubbed through dust washers designed by the Chicago Bridge and Iron Works in cooperation with the Aluminum Ore Co. No measurement of their efficiency has been made to date although, apparently, the exhaust is almost entirely water vapor. Kiln gases are passed through tangential sprays at three levels before exhausting out the stacks.

Wash water is run down the sides (inside) of each collector into a conical bottom which drops its load into a second cone for settling. Clarified water flows into a peripheral launder around the top of the lower cone and is pumped for re-use in the sprays. Makeup water is automatically added through action of a float in the launder.

Settlings are drawn off in a ½-in.



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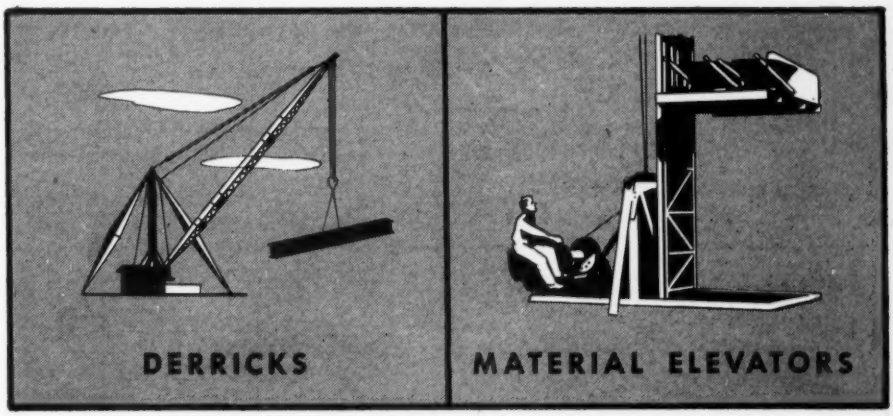

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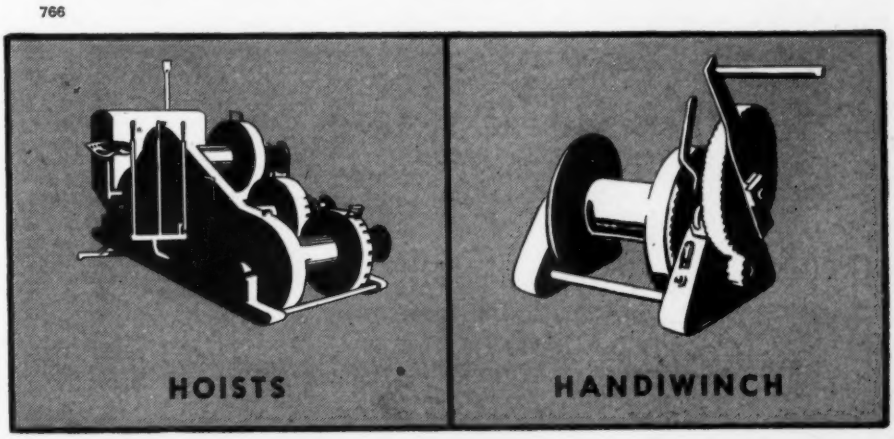

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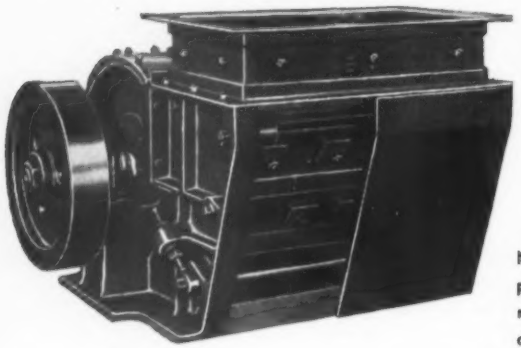

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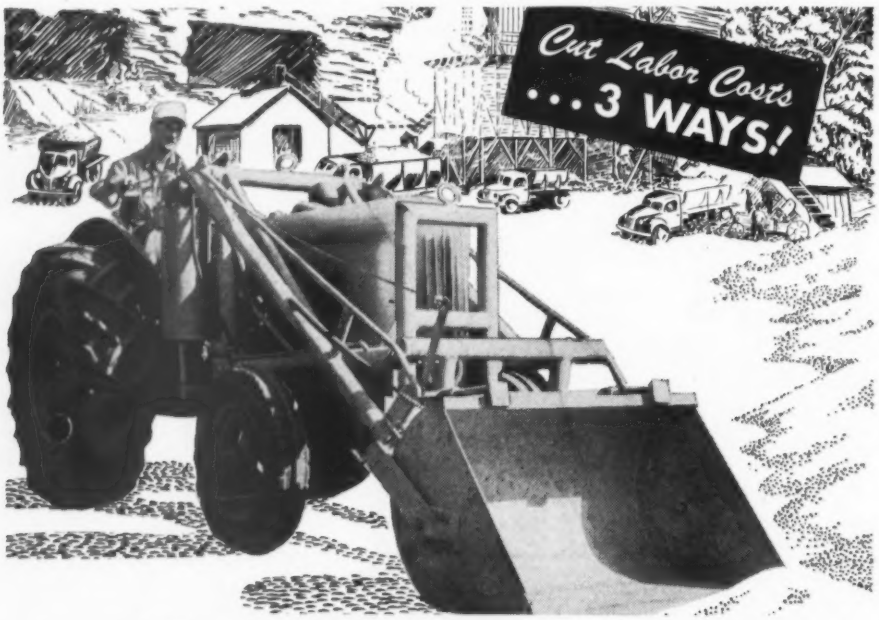

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stream at intervals and are pug-milled (individual pug mills) with dry dust taken from the kiln breeching by screw conveyor. After inter-mixing, the dust is pumped, as a slurry, into the screw conveyors from the Colton-Lang recuperators, thus being blended with fresh kiln feed material. One large screw is to be installed to replace the several pug mills. All the pumping is done with Morris slurry pumps.

Finish Grinding

Two parallel Peck carriers were provided in the plant for handling sinter. One is being used to transport clinker into the overhead coal bins from which the unit coal mills were to have been fed. Gypsum is brought in over the coal handling equipment provided for rail delivery and elevated into the other end of the partitioned coal bin. Gypsum and clinker are proportioned by poidometers and are elevated by the second Peck carrier to an inclined belt conveyor, filling the finish mill bins. Clinker capacity is 10,000 tons, in the coal bins. A large Pangborn dust collector is operated in conjunction with the clinker handling equipment.

The finish mill feed bins are those provided for sinter. Finish grinding equipment provided consisted of three 8- x 16-ft., 2-compartment Traylor tube mills, fed by poidometers. Fuller-Kinyon equipment was installed to pump the mill discharges (into a collecting screw conveyor) back to the raw mill building for final grind through the No. 4, 7- x 40-ft. tube mill, and to transfer the finished product into storage.

Finished product storage capacity is limited to two circular soda ash storage bins of only 35,000 bbl. total capacity, further complicated by the fact that they are not elevated but have hoppers at ground level. Screw conveyors and an enclosed bucket elevator are utilized for bulk loading. Screw conveyors also transfer cement to two 4-spout Bates packers and belt conveyors carry the sacked cement to box cars. Details of the equipment in the packing department and, for that matter, throughout much of the plant are not mentioned in detail herein for the plant is still in process of conversion to cement manufacture and certain changes in methods are contemplated.

Personnel

M. O. MATTHEWS, vice-president and general manager of the Southern Division of Ideal Cement Co., has been directly responsible for the conversion and operation of the Mobile plant. Thomas B. Douglas, general superintendent of Ideal, has supervised the operations.

A. W. HOOTON, chemical engineer, formerly associated with Superior Portland Cement Co., Concrete, Wash., is superintendent of the plant; G. Haskell Rodgers, formerly at Ideal's Portland, Colo., plant, is chief chem-

ist; Harley Fleming, formerly chief electrician at Trinity Portland Cement Company's Houston, Texas, plant, is assistant superintendent; and Sam Lamb, mill foreman, is from the Ada, Okla., plant.

Sweden's Longest Kilns

(Continued from page 144)

to the outside of the concrete silos. Before filling with oil, the inside of the silos was given two coats of shellac mixed with cement to seal pores and minor cavities in the concrete.

At the present rated capacity of 2600 bbl. per day per kiln, clinker is being manufactured with a heat utilization of 1250 calories or 850,000 B.t.u. per bbl. with coal and 1300 calories or 880,000 B.t.u. per bbl. when using oil.

The new kiln is equipped with the latest developments in F. L. Smidth fuel-saving devices. In addition to the recovery of heat through the Unax clinker cooler, previously mentioned, heat exchanger chains were installed in the back end of the kiln. This kiln, like the first unit, also is equipped with a spiral slurry dryer and a Smidth "cross" inside the kiln. The slurry dryer or preheater is a chamber in the kiln a short distance from the inlet which is divided into segments, thus dividing the slurry into different compartments with the effect of exposing smaller quantities of the slurry to the action of the kiln gases. A number of loose coils in these compartments help to expose thin layers of the slurry to the gases. The cross is a heat exchanger system which divides the clinker stream into smaller masses to expose more surface to the hot gases.

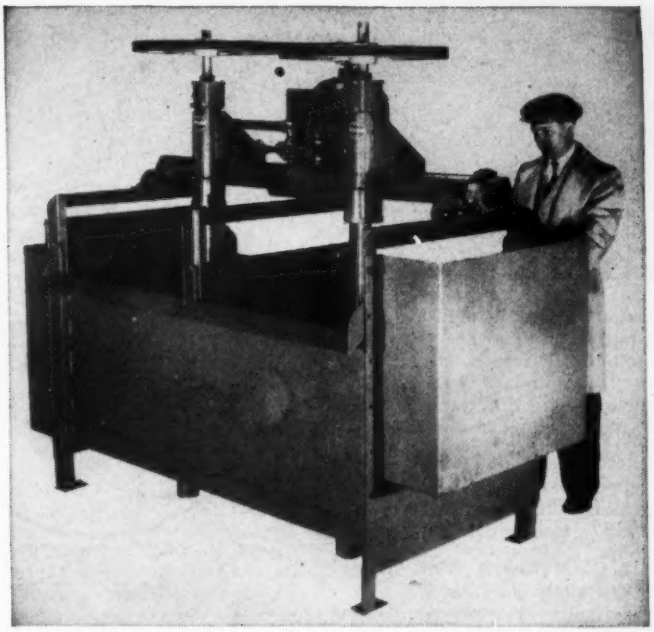
Electrical Dust Collectors

An electrical Precipitator dust collector has been installed on both kilns. As the dust is mainly potassium sulphate it has found a ready market as fertilizer and for the chemical industry. The slurry preheater catches most of the dust that is not gaseous, and the potassium sulphate collected by the Precipitator is therefore surprisingly concentrated. As may be expected, there are less impurities when oil is used, as coal produces some fly ash which is not caught in the slurry preheater.

Clinker from the kiln is carried on a drag conveyor to the storage building. It is ground, after preliminary crushing of the larger lumps, with added gypsum through three 7.9- x 39.5-ft., 4-compartment Smidth mills in open circuit. The finished cement is pumped into silos by a Fluxo cement pump. Capacity in storage is 290,000 bbl., in seven 47½-ft. diameter by 95 ft. reinforced concrete silos.

As the interesting quarry and raw mill operations remain without change and were described in full in the January, 1946, issue of ROCK PRODUCTS, the reader is referred to this issue for this description.

AGITAIR Sets the Pace



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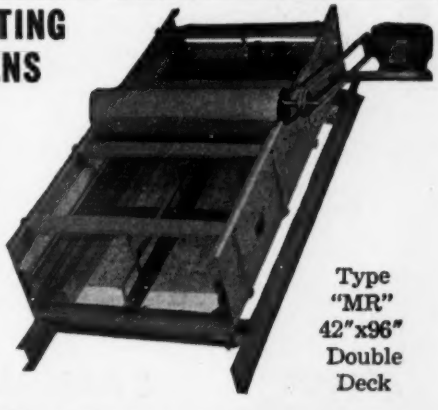

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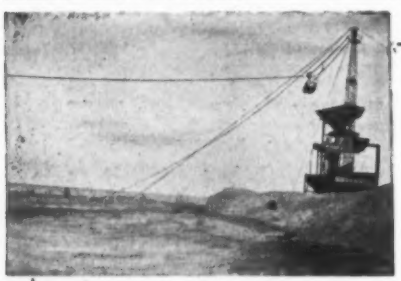

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Asbestos Dust

(Continued from page 105)

as an experimental unit. This collector was tapped into the dust system and subjected to a series of rigid tests by the company's engineers. The purpose of the tests was to determine: 1—the optimum air-cloth ratio; 2—the cleanliness of the discharge air; 3—the back pressures resulting from various operating procedures; and 4—the effectiveness of the shaking mechanism. The fourth point was the one about which the greatest doubt existed and it received the most rigid tests. On several occasions asbestos floats were actually shoveled into the collector until the bags were stuffed and the collector then shut off and shaken. The back pressure returned to normal almost immediately.

These tests showed that the filter would handle an air flow of 4½ c.f.m. per square foot of cloth and, with an operating and cleaning cycle of 40 minutes, the back pressure varied between ½ and 1½ in. of water. The discharged air was well within the standard health requirements of less than 10 million particles smaller than 10 microns in one cubic foot of air.

On the basis of these tests a 400,000 c.f.m. unit was purchased and installed to handle the complete dust load from this mill.

The entire installation was made with practically no interruption in the regular operation of the mill. It is estimated that approximately two hours of operating time were lost when the dust collector was being switched into the system.

Figs. 1 through 4 show the construction and operating features of the collector as it is installed. This is a bag type collector with bags of sateen weave cotton fabric, 8 in. in diameter and 17 ft. 6 in. long. Spring steel bands hold the bottom of the bags in aluminum cell plates while the tops of the bags are suspended from the shaking mechanism. The shaking mechanism consists of a motor driven eccentric which transmits a horizontal shaking action to the bags. The resulting bag motion is similar to that obtained when a small rug is shaken by hand. The spring steel clamping arrangement at the cell plate permits easy bag replacement. One man can remove and replace a bag of this type in less than one minute.

There are six collecting units arranged in such a way that five are always in operation while the sixth is being cleaned. The cleaning cycle is controlled automatically by an electric timing mechanism shown in Fig. 2, and it operates on a predetermined time cycle. At the proper time the electrical control mechanism causes an electro-pneumatic valve to close the inlet dampers. After the pressure in the collector has equalized another electrical switch causes the shaker mechanism to start and the collected

dust is dropped down into the hopper below. From there it is carried by means of a screw conveyor to one end of the hopper where it drops through a chute to a conveyor box in the floor below. A drag chain in this conveyor duct carries the floats from all six collectors to a central point of discharge where it is graded and bagged for shipment.

Only once has any difficulty been encountered in the maintenance of proper back pressure. This occurred when an exceptionally wet batch of rock was being processed and the moisture content of the dust was sufficient to cause an almost impermeable cake to build up in the bags. This was corrected by the simple expedient of shutting off the wet rock and circulating dry dust through the collector until the pressure returned to normal.

This is an "all pressure" system with the necessary pressure being supplied through the cyclone separators used in the grading process. No supplementary fans were required when the dust collector was added to the system. The additional power required to overcome the resistance of the system was provided by using an improved type of fan wheel which increased the fan performance and efficiency to such a degree that not a single horsepower was added to the total fan load.

No serious trouble has been encountered since the installation went into operation although it is currently being operated at a 10 per cent overload. Approximately 22 tons per day of marketable asbestos is being collected. This material is all regraded and bagged according to its market classification.

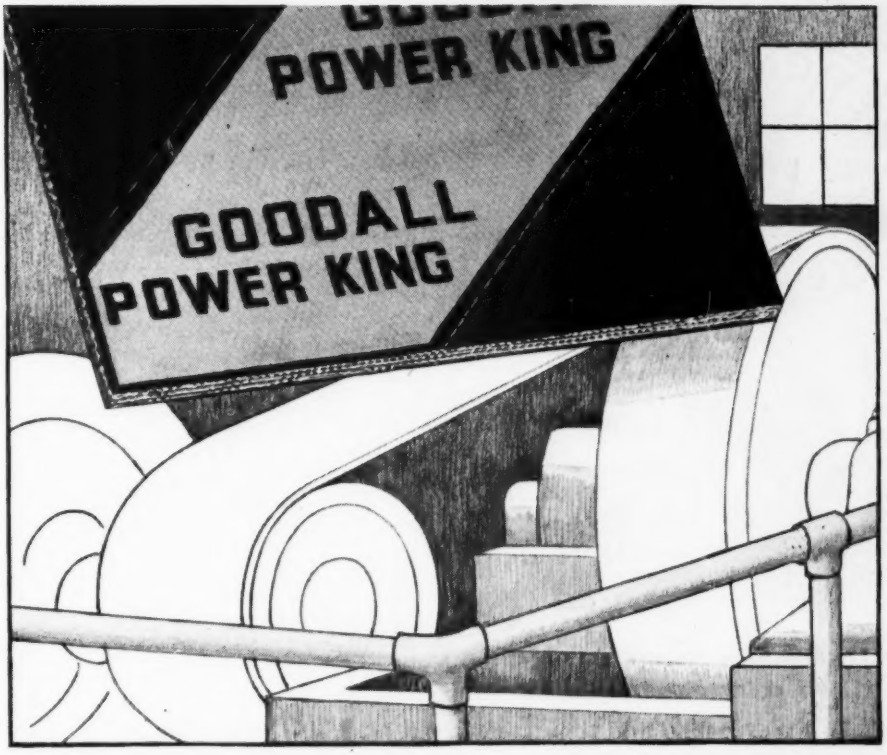
Cement Production

BUREAU OF MINES reports that production of finished portland cement during April, 1947, totaled 14,566,000 bbl. or 15 per cent greater than that reported for April, 1946. Mill shipments reached 15,414,000 bbl., a figure essentially the same as that reported for April of the previous year. Stocks of finished portland cement on April 30, 1947, were 21,330,000 bbl., an increase of 34 per cent over that reported for April, 1946. Demand for cement was higher in 10 districts and lower in nine, than that in April of last year. The long-term trend in production of finished portland cement continues upward, increasing during the first four months of 1947 at an average rate of 2,989,000 bbl. per month.

The following statement gives the relation of production to capacity, and is compared with the estimated capacity at the close of April, 1947 and April, 1946.

RATIO (PER CENT) OF PRODUCTION TO CAPACITY

	Apr. 1947	Apr. 1946	Mar. 1947	Feb. 1947	Jan. 1947
The month	74.0	64.0	69.0	68.0	66.0
12 months	73.0	50.0	72.0	71.0	70.0



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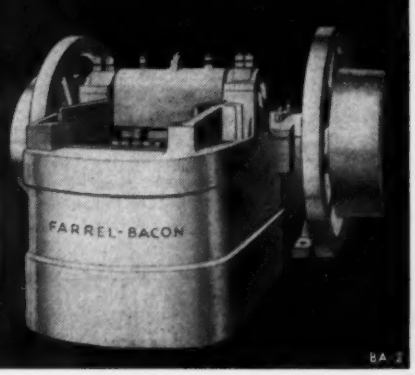

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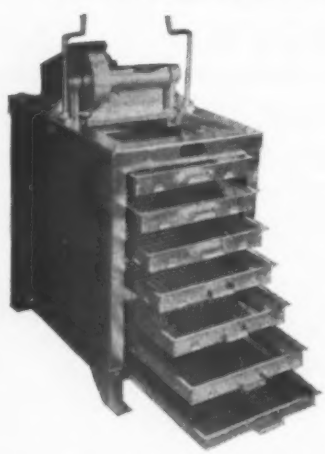

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Proportioning

(Continued from page 133)

(c) Continued

$\frac{.0316}{.9270} = 0.0341$ $\frac{0.0341}{1.5087} = 0.0226 = 2.26\%$ shale.
Total = 1.5087

Thus 97.74 per cent of the bin and 2.26 per cent shale will give 50.0 C_3S and 8.7 C_3A mix.

II. To correct the C_3A from 8.7 to the 5.8-6.2 range.

(a)

6 — (—136) = 142.0 parts bin.
8.7 — 6 = 2.7 parts iron ore.

144.7 total parts.

(b) To change to percentages, ignited basis.

$\frac{142}{144.7} = .9813 = 98.13\%$ of first mix — 96.84% bin, 3.16% shale.

$\frac{2.7}{144.7} = .0187 = 1.87\%$ iron ore.

Proof:
98.13% of 8.7 C_3A = 8.54
1.87% of —136 C_3A = —2.54

100% = 6.00 C_3A

The new C_3S is also obtained
98.13% of 50.0 C_3S = 49.07
1.87% of —200 C_3S = —3.74

100% = 45.33 C_3S

(c) To change ignited to unignited basis, it will be necessary to calculate the percentage of loss in the first corrected mix so the 100 — loss/100 figure can be obtained.

Bin loss = 34.33 Shale loss = 7.30
97.73% of 34.33 = 33.55
2.26% of 7.30 = 0.16

Total = 33.71

$\frac{100 - 33.71}{100} = .6629$

Thus:

$\frac{.9813}{.6629} = 1.4803$ $\frac{1.4803}{1.4999} = .9869 = 98.69\%$ of 97.74% bin and 2.26% shale

$\frac{.0187}{.9538} = 0.0196$ $\frac{0.0196}{1.4999} = .0131 = 1.31\%$ iron ore.

Total = 1.4999

(d) To get the absolute percentages of bin and shale with added iron ore.

98.69% of 97.74 = 96.46% bin.
98.69% of 2.26 = 2.23% shale.
1.31% iron ore.

100.00% total

III. The above proportions will give a mix of 45.3 C_3S and 6.0 C_3A. If it is desired to have the C_3S closer to 50.0, it will only be necessary to increase the amount of bin and cut the shale a small amount. As 2.23 per cent shale lowered the C_3S from 71 to 50, 0.1 per cent decrease in shale and a 0.1 per cent increase in the bin should increase the C_3S about 0.94. Thus an increase of 0.3 per cent bin and a 0.3 per cent decrease in shale should raise the C_3S to 48.1.

(See table below)

IV. As the entire bin must be used at one time, it will be necessary to calculate the weight of shale and iron ore needed to mix with it to give the C_3S 47.9 and C_3A 6.0. The bin holds 300 tons.

$\frac{300}{96.76} = 3.10$ tons per 1 per cent.

96.76% = 300 tons bin.
1.93% = 6 tons shale.
1.31% = 4.0 tons of iron ore.

Thus if 6 tons of shale and 4.0 tons of iron ore are added to the 300 ton bin, the mix will be 47.9 C_3S and 6.0 C_3A.

Reference

*A.S.T.M. Standards on Cement. Oct, 1946, p. 2.
$C_3S = 4.07\ CaO - 7.60\ SiO_2 - 6.72\ Al_2O_3 - 1.43\ Fe_2O_3$.
$C_3A = 2.65\ Al_2O_3 - 1.69\ Fe_2O_3$.

May Open Phosphate Plant

W. R. GRACE CO., SAN FRANCISCO, CALIF., operators of the Grace steamship lines with subsidiaries engaged in the production of commercial fertilizer, are investgating the possibility of using the government-owned Spokane magnesium plant in fertilizer ingredient production. The company is exploring the economic feasibility of reducing phosphate rock at the Spokane plant to a concentrate which would be shipped to the company's fertilizer plant in Oakland, Calif.

Magnesium Plants Purchased

DOW CHEMICAL CO., MIDLAND, MICH., recently bought two magnesium plants at Ludington, Mich., from the War Assets Administration. Dow operated the plants during the war, and since has held them on a lease obtained from the Reconstruction Finance Corporation.

	96.76% Bin	1.93% Shale	1.31% Iron Ore	Total Unignited	Ignited
SiO_2	13.58	1.21	0.12	14.91	22.39
Al_2O_3	3.09	0.28	0.03	3.40	5.11
Fe_2O_3	1.82	0.11	1.05	2.98	4.48
CaO	42.17	0.14	0.03	42.34	63.59
MgO	2.46	0.05	0.01	2.52	3.78
Loss	33.22	0.14	0.06	33.42	
100-loss				65.53	
C_3S					47.9
C_3A					6.0

Manufacturers' News

Link-Belt Co., Chicago, Ill., has elected Harold L. Hoefman as vice-president in charge of manufacturing, with headquarters in Chicago. David E. Davidson will succeed Mr. Hoefman as general manager of the Pershing Road plant in Chicago. Robert C. Becherer has been appointed plant manager of the Ewart plant in Indianapolis; Warren H. Maxwell has been made general superintendent of the plant; S. L. Houck becomes assistant general superintendent; and Carl O. Schopp has been made superintendent of the plant foundry.

D. E. Davidson

H. L. Hoefman

Mack Trucks, Inc., New York, N. Y., has appointed Harry Oldham as superintendent of the New Brunswick, N. J., foundry, and will be in direct charge of the production of Mack castings. J. G. Van Nest has been named assistant to O. L. Lear, purchasing agent at the Allentown, Penn., plant.

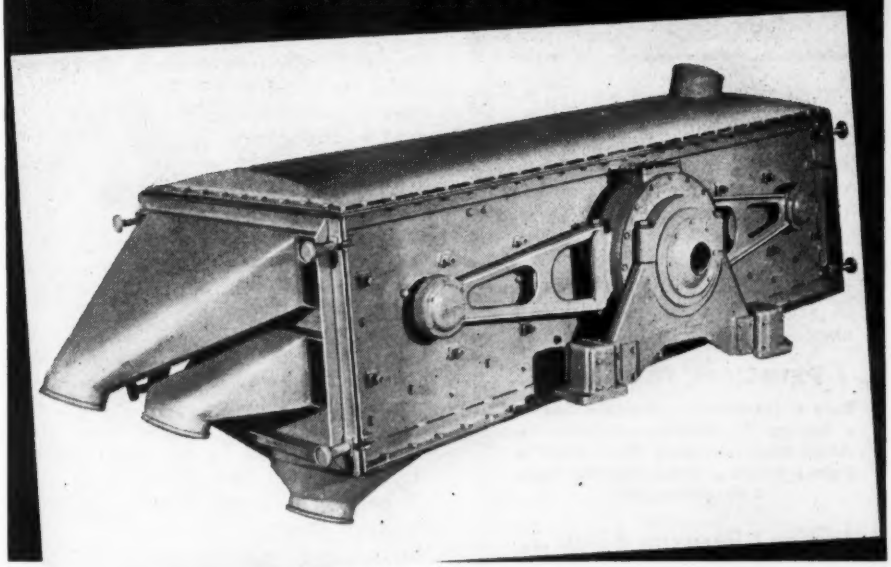
Allis-Chalmers Mfg. Co., Milwaukee, Wis., has formed a new turbo-power development department in the engineering development division with R. C. Allen, formerly head of the steam turbine department, as manager and chief engineer. W. A. Yost, formerly assistant manager, succeeds Mr. Allen as manager of the steam turbine department.

Laclede-Christry Clay Products Co., St. Louis, Mo., announces that R. T. Risk, secretary-treasurer of the company, has been elected president of the St. Louis Chapter of the National Association of Cost Accountants.

General Electric Co., Schenectady, N. Y., announces that L. R. Boulware, vice-president, has been placed in charge of employe relations, succeeding E. D. Spicer, vice-president, who will have charge of the manufacturing policy, continuing as a member of the president's staff. Ralph J. Cordiner, vice-president and assistant to the president, will take over temporarily from Mr. Boulware the activities of affiliated manufacturing companies.

Chevrolet Motor Division, Detroit, Mich., has announced the opening of its new assembly plant in Flint, Mich. J. A. Foley, former manager of the Baltimore assembly plant, will manage the new Flint plant. H. W. Vetter will be general superintendent; and R. T. Murphy, comptroller.

Selectro Control INSURES HIGH EFFICIENCY SCALPING OF FINE MATERIALS...



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- **Selective Throw: 8 vibration adjustments.**
- **Tilt Adjustable: Flow of material can be controlled at all times by adjusting tilt.**
- **Oil Lubrication: Splash method with fly wheel operating in perfectly sealed oil cases.**
- **Easy Cloth Change.**
- **Rubber Mounted: No vibration can be communicated to other equipment.**
- **Built in Safety: All moving parts of vibrator assembly fully enclosed.**

Your cement scalping or other scalping involving removal of lumps or foreign matter from extremely fine materials is best accomplished with a scalping screen offering maximum control.

Selectro's 8-way vibration adjustment and easily controlled tilt enables your operator to maintain maximum screening efficiency. Adjustments to overcome variations in material consistency can be made while the screen is in operation.

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CONTINENTAL EUROPE & INDIA
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Dependable steel products and unequalled steel service facilities . . . available for your steel-buying convenience at twelve conveniently located Ryerson plants. Because of great demand, all sizes are not always in stock; but we usually can suggest a reasonable alternate.

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The Harrington & King PERFORATING CO.

5650 FILLMORE ST., CHICAGO 44, ILLINOIS
114 LIBERTY ST., NEW YORK 6, N. Y.

Electric Machinery Mfg. Co., Minneapolis, Minn., has announced the appointment of Carl C. Nelson and James DeKiep as members of the board of directors. Mr. Nelson is works manager in charge of factory production and Mr. DeKiep is chief engineer.

Joy Mfg. Co., Pittsburgh, Penn., has announced the appointment of E. M. Platts as vice-president in charge of sales. He was formerly vice-president in charge of coal mining sales. Mr. Platts started his career in the mining industry 33 years ago. He was one of the principal incorporators of the La-Del Conveyor & Mfg. Co., and was head of the sales force until La-Del became a division of Joy Mfg. Co. In his new postion Mr. Platts will have supervision over the sales of all products manufactured by the company.

E. M. Platts

Bemis Bro. Bag Co., St. Louis, Mo., has announced the opening of a sales office in Phoenix, Ariz. H. O. Parrent is in charge of the office.

M-R-S Mfg. Co., Jackson, Miss., announces the appointment of Thomas Q. Hathorn, Hollis H. McBride, Charles Robert Morris, and Harper Hughes Spragins as district sales representatives.

Marion Power Shovel Co., Marion, Ohio, has on exhibition in the Metropolitan Museum of Art in New York, N. Y., a painting showing a Marion Type 4161 power shovel loading ore in Utah mines. The painting was one of the 300 finally selected as the best of nearly 8000 entries submitted from the best advertising art.

International Paper Co., New York, N. Y., announces that H. Currie has been appointed district sales manager of the International Paper Products Division in New Orleans, La., and Frank N. Gladden has been made district sales manager of the same division in Los Angeles, Calif.

Jaeger-Lembo Machine Corp., Flushing, L. I., N. Y., announces that Joseph A. Thomas has returned from service with U. S. Army engineers in the European theater of operations and will serve as sales representative for the company in the northern New Jersey area.

Goodyear Tire & Rubber Co., Akron, Ohio, announces that O. A. Schilling has been named Eastern sales manager of the mechanical goods division, succeeding H. D. Foster, who was recently appointed manager of the division, which embraces Texas, Oklahoma, Mississippi, Louisiana, and parts of Kansas, Arkansas, and New Mexico. E. J. Thomas, president, has had conferred upon him the degree of

FEEDOWEIGHT automatically proportions, feeds and batches clinker, gypsum and other materials by weight. A Powered Feed Regulator regulates the control gate leaving the scale beam free to respond instantaneously to changes of load.

Merrick Scale Mfg. Co.
Passaic, New Jersey

PINCH VALVES

MASSCO GRIGSBY

No metal touches pulp or liquid. No glands. Freezing does not destroy sleeve.

NO METAL CONTACT

Successfully used for transporting abrasive and/or corrosive pulps and liquids . . . wherever severe wear makes replacement of metal type valves too costly. Collapsible sleeve of rubber or synthetic. Closes tight even on solid particles. No packing glands; not destroyed by freezing. Sizes: 1" to 12" dia.

THE MINE & SMELTER SUPPLY COMPANY
Denver Salt Lake City El Paso
1775 Broadway, New York

Humane Letters by Heidelberg College, Tiffin, Ohio.

St. Regis Sales Corp., New York, N. Y., has announced the opening of a multiwall paper bag sales office in Louisville, Ky., under the supervision of Charles C. Keefer.

United States Rubber Co., New York, N. Y., has appointed Richard B. Carland as sales promotion manager of the wire and cable department, with headquarters in New York, N. Y.

Reardon Industries, Inc., Cincinnati, Ohio, which has been a proprietorship for many years, owned by W. J. Reardon, and has engaged in the manufacture and distribution of concrete colors, chemicals and insulations and their erection for building and industry, has filed articles of incorporation. William J. Reardon is president; Charles H. Zix, vice-president and treasurer; Robert L. Smith, vice-president; and Jacob W. Schweizer, secretary.

International Harvester Co., Chicago, Ill., announces that F. E. Reishus, formerly manager at Sioux Falls, S. D., has been transferred to Lincoln, Nebr., to succeed J. L. Henn, who has retired. E. R. Zimmerman, formerly assistant manager at Sioux Falls, has been promoted to branch manager at that plant.

Caterpillar Tractor Co., Peoria, Ill., has promoted E. W. Ryder to the position of parts manager for the Eastern division. He replaces C. D. Byrns, who has resigned to join the Arizona Machinery Co., a Caterpillar distributor. W. E. Doersam will succeed Mr. Ryder as assistant parts manager for the Western division.

Hewitt Rubber Division of Hewitt-Robins, Inc., Buffalo, N. Y., has appointed Ellis & Lowe Co., as a distributor in the Tampa, Fla., area.

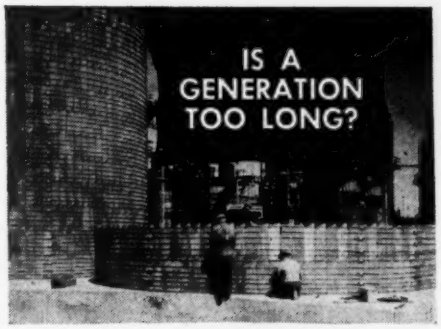
National Bearing Division of the American Brake Shoe Co., New York, N. Y., announces the appointment of Emmett A. Williams as vice-president in charge of operations, and I. E. Cox as vice-president in charge of engineering.

Hardinge Co., Inc., York, Penn., has changed the address of the San Francisco district office to 24 California St. G. A. Wallerstedt is district manager.

Hendrick Mfg. Co., Carbondale, Penn., has announced the appointment of H. H. Buckley as Pittsburgh district manager, succeeding Bruce G. Shotton who passed away recently.

Material Movement Industries, a partnership, has been dissolved and Material Movement Industries, Inc., a corporation, has been formed and has assumed the assets and liabilities of the former partnership. There will be no change or interruption in operations or management.

Chicago Construction Equipment Co., Chicago, Ill., announces that James S. Benson, general manager, has been elected to the board of directors of the company.



Neff & Fry bins serve for a generation with virtually no upkeep expense. If you wouldn't want them to stand that long, they could be dismantled and reconstructed to fit another layout.

Each stave interlocks with six surrounding ones. This makes tight, rigid joints. Steel hoops are stretched around each tier to brace the staves against internal pressure. The bin can be disassembled by removing the hoops and detaching the staves.

Neff & Fry bins are erected by trained crews sent anywhere. Each job is specially engineered. Diameters and heights available as required. Ask for catalog containing full information and photos of installations.

THE NEFF & FRY COMPANY
CAMDEN, OHIO

SUPER-CONCRETE STAVE

NEFF & FRY STORAGE BINS

Safety goes hand in hand with Quality Workmanship
THIS SAFETY AWARD
is Presented to
Lima Locomotive Works Inc.
For outstanding effort and achievement by their Supervisory Forces and Employees as GROUP (1) WINNER in the
Allen County Industrial Safety Campaign
January 1-December 31, 1946
The Industrial Commission of Ohio
Division of Safety and Hygiene
LIMA
THE LIMA DIAMOND FOR OVER 75 YEARS AN EMBLEM OF QUALITY WORKMANSHIP
LIMA

Safe working conditions go hand in hand with quality workmanship. This claim was recently substantiated when the Industrial Commission of Ohio, Division of Safety and Hygiene, awarded to Lima Locomotive Works, Incorporated, a certificate of merit for having the best safety record in the heavy industries division for 1946. In design and manufacture, LIMA has always taken every precaution to safeguard the men who work around LIMA machines. For instance, all exposed gears are protected by safety guards; platforms around the operator's position have safety treads; points of lubrication are centralized to eliminate oiling dangers and the compact arrangement of the machinery makes every part easily accessible. Be safe with a LIMA. Records prove that a safe machine produces greater output.

LIMA LOCOMOTIVE WORKS, INCORPORATED
Shovel and Crane Division LIMA, OHIO, U. S. A.
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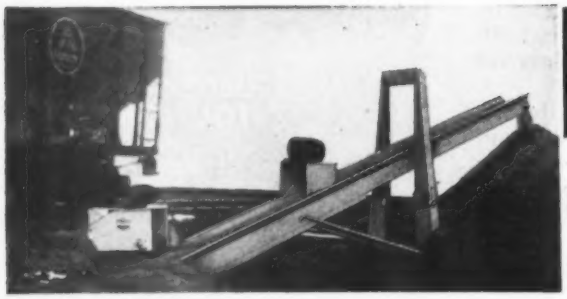
Capacities . . . SHOVELS ¾ YARD TO 5½ YARDS • CRANES 15 TONS TO 100 TONS • DRAGLINES VARIABLE . . . *A Type and Size for Every Job*



BAUGHMAN L & M Combination LOADER-UNLOADER

Unloads cars ... loads trucks ... can be moved to make a pile 90 feet long CAPACITY...30-60 TONS PER HOUR

Gives you utmost "freedom of action"! The L & M Combination consists of two separately-powered units—one to convey material from under the full width of the car . . . the other to convey in a full half-circle, approximately 90 feet long or build high, cone-shaped piles. Each unit is portable . . . can be quickly shifted to other operations. *'HI-SPEED'* operation saves time and money.

RUGGEDLY BUILT of high tensile alloy steel . . . 30% lighter yet 17% stronger and tougher and 5 times more resistant to rust and abrasion than if built of ordinary steel. Arc welded construction . . . ball and roller bearings throughout. Chain and flights made of steel roller chain having ultimate strength of 16,000 lbs. per strand.

LOW-IN-PRICE — smaller yards can afford the L & M, yet it has the capacity to meet big yard requirements. PROMPT DELIVERY — no long waiting. Order a Baughman and obtain immediate use. See your BAUGHMAN distributor, or write . . .

(Above) Model M, elevating conveyor with 5 h.p. electric motor. Note direct line drive to head shaft—no slipping belts or flopping chains to lose power and require constant service. (Below) Model L, hopper car unloader with 7 h.p. gasoline engine. Both models available with belt (for abrasives) or without (for most purposes).

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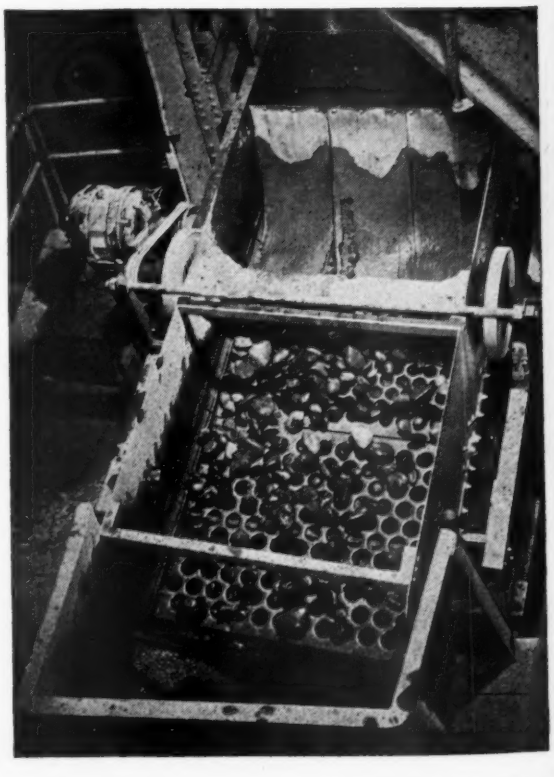
Only from Hendrick can you secure accurately perforated metal plate that is heat treated for longer service, making it unrivaled for vibrating and shaking screens. It maintains uniformity of mesh under the hardest kind of usage.

Whatever your screening requirements, you can meet them exactly from the wide range of shapes and sizes of openings, thicknesses, and variety of materials, in which Hendrick Perforated Plate is available. Write for full information.



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Perforated Metal Screens
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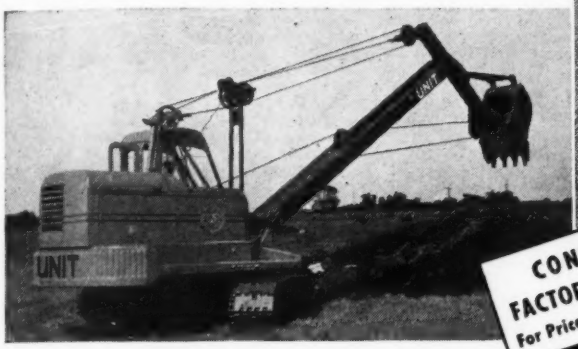
UNIT takes a deep bite . . . swings fast and easy . . . moves dirt in a hurry. That's why it is the preferred excavator . . . used extensively all over the nation. Engineered for the really tough jobs with drop forged alloy steel gears and shafts completely enclosed and oil-sealed in UNIT's exclusive One-Piece Gear Case. Straight line engine mounting . . . Automatic traction brakes . . . Disc type clutches. UNIT's modern Full Vision cab promotes SAFETY, speeds up job. Investigate today!

Quick change in the field to any desired attachment: Shovel . . . Crane . . . Clamshell . . . Dragline . . . Trenchoe . . . Magnet . . . Grapple.



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Features include—Manganese steel hammers, heavy duty bearings, adjustable breaker plate, hammer adjustments overcome wear, economical to operate.

The "Slugger" is built in Seven Sizes — from 30 to 150 horsepower — write for illustrated bulletins today.

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CUTAWAY VIEW of "Slugger" showing heavy duty hammers, liners and discs.

OLDEST AND LARGEST BUILDERS OF HAMMERMILLS IN THE WORLD

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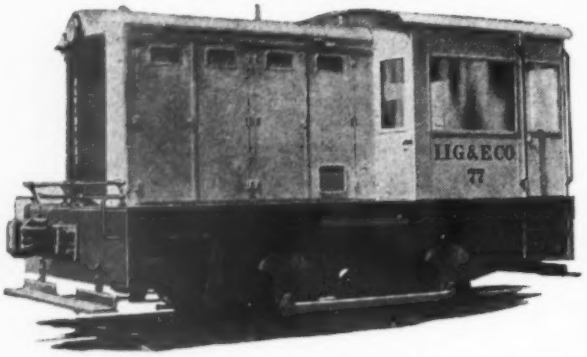
PATENT CRUSHERS GRINDERS SHREDDERS

Move MORE at Lower COST

STEAM—GASOLINE—DIESEL LOCOMOTIVES—ELECTRIC OR MECHANICAL DRIVE



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It will be a pleasure to send you our latest Haulage Survey Data Sheet to enable you to describe your haulage conditions accurately and completely. Our engineers will analyze the data you submit and recommend the power unit that will perform most profitably for you.

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G.P.M.	HEAD	MAKE	MOTOR
225	100	Ing. Rand	115 D.C.
200	95	Worthington	3/60/220
30	40	Worthington	1/60/115

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K.W.	MAKE	A.C. DRIVING END	D.C. VOLTS
800	Wtg.	3/60/13200	240
500	G.E.	3/25/6600	250
500	G.E.	3/160/2300	250
300	G.E.	3/60/2300	220
200	G.E.	3/60/440	250
150	G.E.	3/60/2300	275
100	A.Ch.	3/60/440	275
90	G.E.	3/60/440	60
90	G.E.	3/60/2300	60
75	G.E.	3/60/440	125
75	Wtg.	3/60/2300	110
75	Elec. Pdts.	3/60/220	125
75	Wtg.	3/60/220	250
65	A.Ch.	3/60/2300	110
50	G.E.	3/60/220	250
50	C. Wheeler	3/60/230	240

● SLIP RING

H.P.	MAKE	TYPE	VOLTS	SPEED
150	Wtg.	CW	220	1800
100	Wtg.	CW	220	1200
100	Wtg.	CW	220	1800
75	Wtg.	CW	220	1200
50	L. Allis	GH	440	870
50	G.E.	MT	440	1800
40	G.E.	MT	220	1200
40	G.E.	MTC	220	1160
40	G.E.	MT	220	860
40	G.E.	MT	440	860
35	F. Morse	UAV	220	1800
35	G.E.	I	440	1140
35	Linc	FR	220	900
35	Wtg.	CW	440	1200
30	G.E.	MT	220	570
30	Linc	FR	220	900

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Whether you need one machine or a complete plant, consult with us. Our complete engineering service can help you. Profit by using the efficient, productive EHRSAM system.

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The features embodied in the new model GAYCO Centrifugal Air Separator make them a leading means of increasing the capacity and efficiency of all types of grinding mills. They have quick, positive adjustment. When once adjusted they are not affected by variation in speed or rate of feed.

They require very little power to operate. And they feature the exclusive GAYCO principle of rejecting coarse particles by means of a centrifugal sizing fan. They separate 99% through 325 mesh, and give 35% to 30% greater recovery of fines.

● Manufacturers also of "Reliance" Crushers, Screens, Elevators, Conveyors, Bin Gates, Grizzlies. Complete crushing, screening, and washing plants for crushed stone, sand and gravel.

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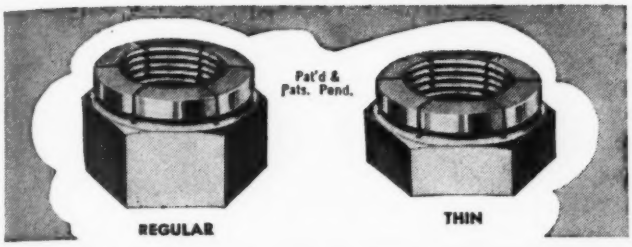
Canadian Representative: F. H. Hopkins & Co., Ltd., Montreal

FACTORY & LABORATORY, KINGSTON, N.Y.

FREE SAMPLES



FLEXLOC

"Flexloc" is of a one-piece all-metal construction, available in U.S.S. and S.A.E. thread series. Every thread of the "Flexloc" — including the locking threads — takes its share of the load, and the torque is unusually uniform because it is controlled. "Flexloc" accommodates itself to a wide range of tolerances . . . can be used over and over again, without losing much of its locking torque . . . is not affected by temperatures likely to be met within the field of Mechanical Engineering . . . being a "stop" nut, it *stays* locked in any position on the threaded member.

It is made by the manufacturers of the unexcelled "Unbrako" Socket Screw Products — guaranteeing quality. Sizes from #6 to 1" in diameter, in both "regular" and "thin" types (shown above).

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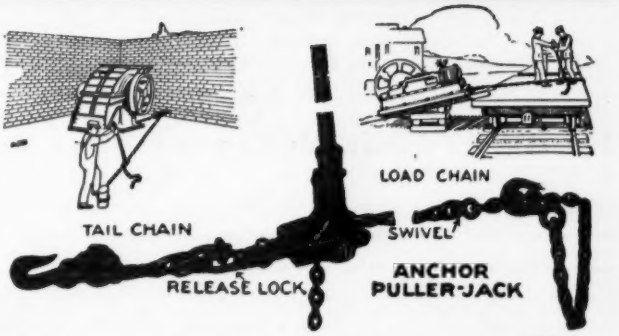

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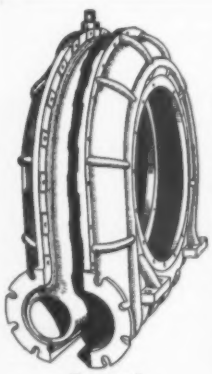

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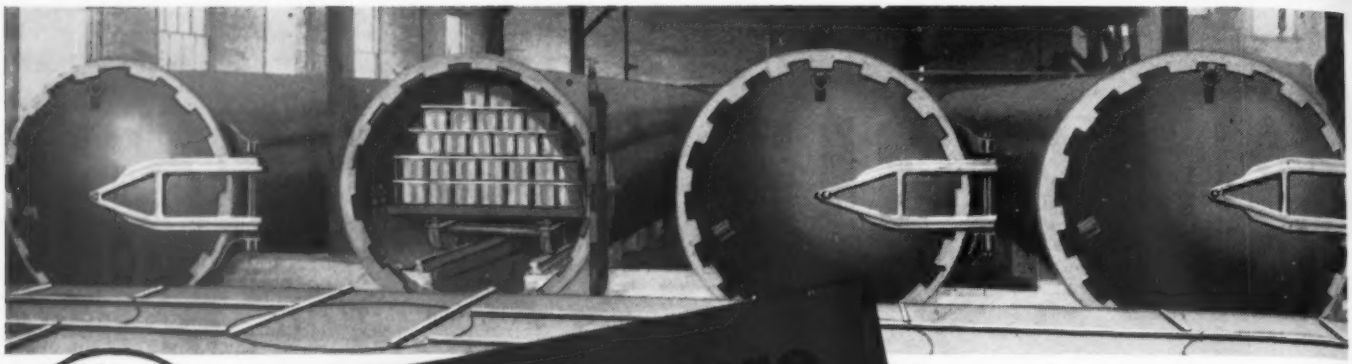

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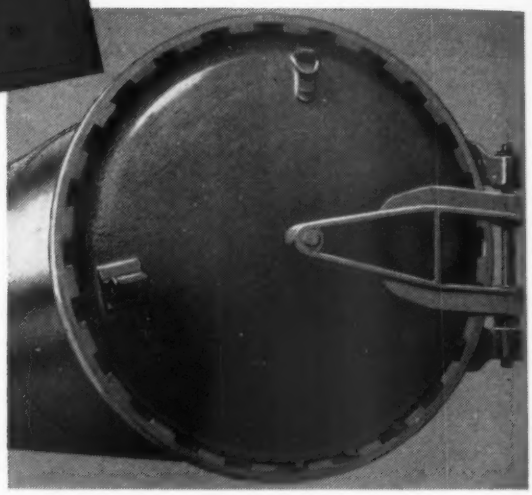

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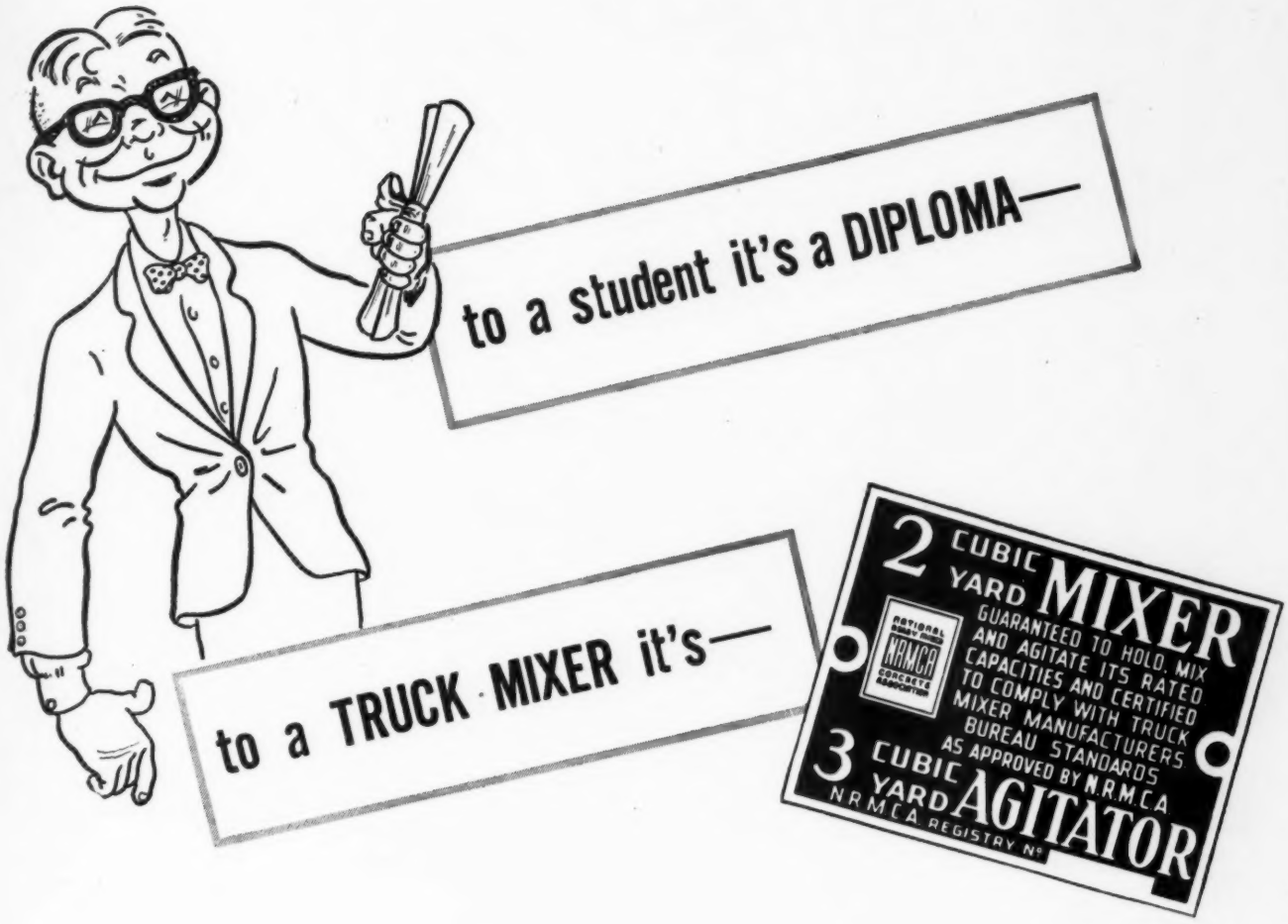
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GUARANTEED TO HOLD, MIX AND AGITATE ITS RATED CAPACITIES AND CERTIFIED TO COMPLY WITH TRUCK MIXER MANUFACTURERS BUREAU STANDARDS AS APPROVED BY N.R.M.C.A.
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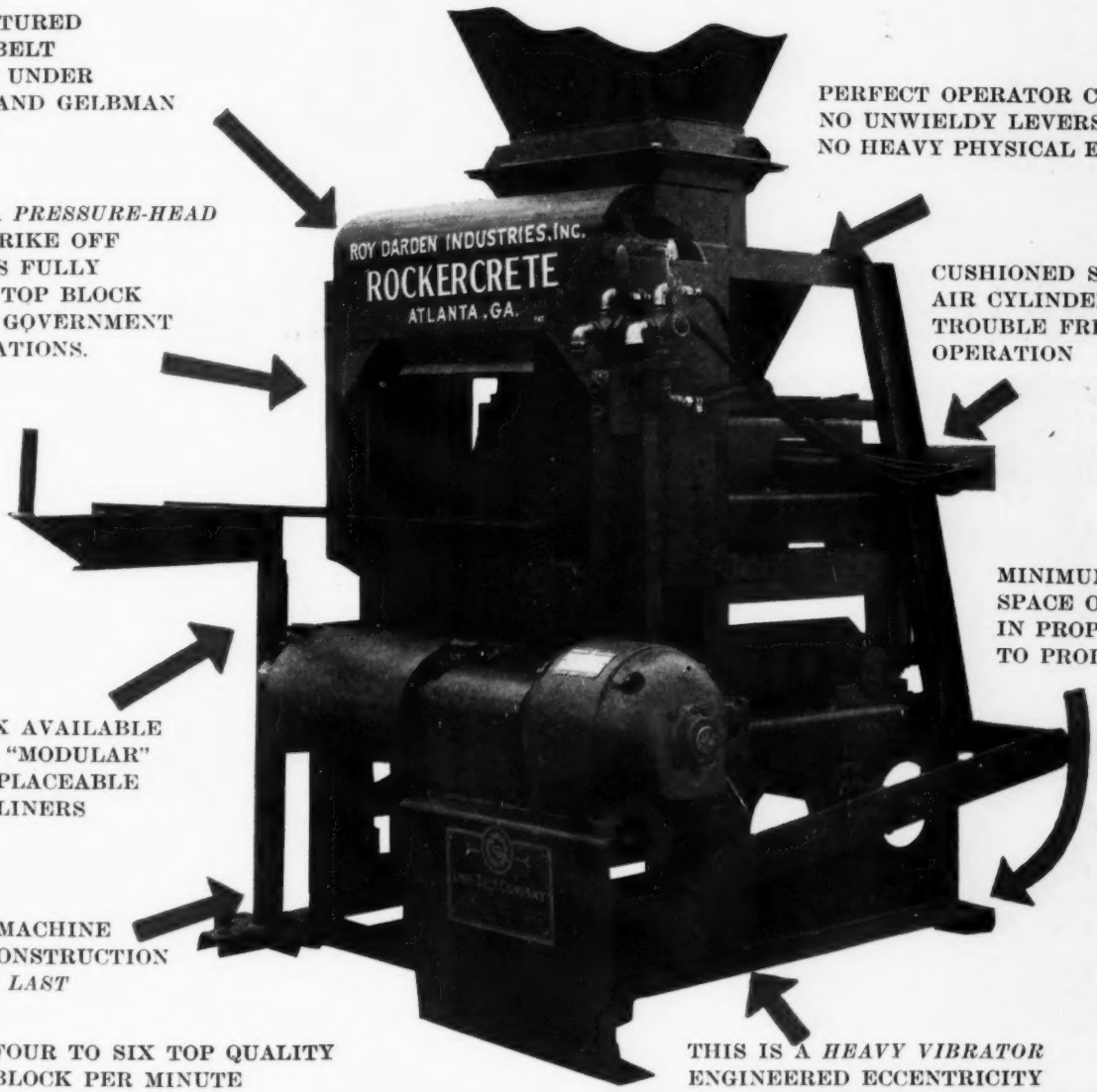

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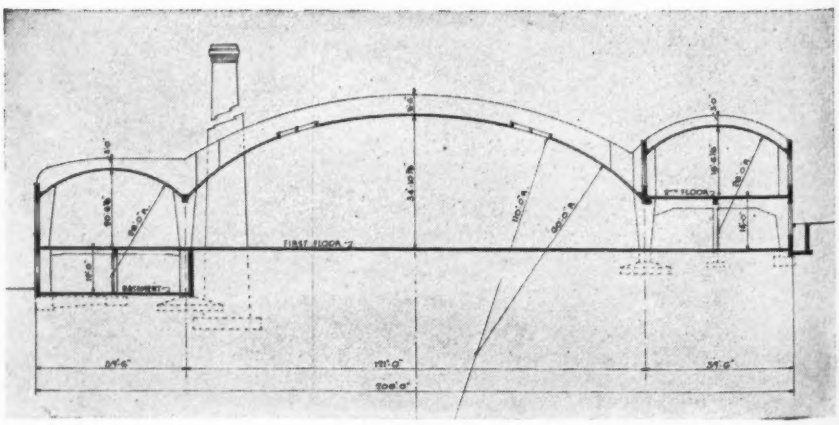

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Block Business Booming In the Pacific Northwest

Overlake Concrete Products Co. is making pumice block and plans to enter into the pipe and roofing tile market

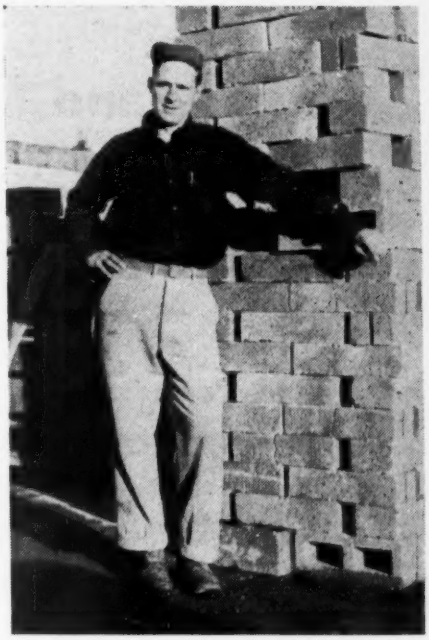
By W. B. LENHART

IN THE PACIFIC NORTHWEST where there are at least 500 sawmills operating on full schedules, new lumber is to be seen every few miles as one drives through the states, yet lumber to the local inhabitants is probably harder to get here than in states with less lumber resources. It is explained that others are willing to pay more for lumber than the local people. Be that as it may, this is one of several reasons why the building block and concrete product business is making rapid strides in the states of Oregon and Washington.

During the past year, 40 new plants for manufacturing concrete products were established in the Northwest. One manufacturer of low-priced block equipment on the Pacific Coast told me recently that he was selling about ten machines per day. Many of these machines were going to new producers as well as those already established. Many of these plants are doomed to failure at the start for some are poorly financed, poorly located, inexperienced both in manufacturing and in selling. "It takes more than a concrete mixer and a hand-operated block machine setting out in an open field to make any great profits in the block business," said one old-timer. Further south, for example, quite a few new plants were started by ex-G.I.'s who with very limited capital, largely borrowed money, threw together some kind of a plant. Hardly before they got started the cement shortage aggravated by the shortage of paper (for paper sacks) put a crimp in their plans that was serious. Bulk cement users had a better break and rode through the crisis without any great inconvenience.

Promoting Concrete Pipe

In the Puget Sound area the concrete pipe manufacturers have been among the pioneers in the manufacture and selling of concrete pipe. Their association here in the Northwest, the Concrete Pipe and Products Association, headed by Cotton Howard, secretary and engineer, has done much to impress the users of pipe, particularly the State Highway and City Engineers, of the merits and economy of their product. Mr. Howard rightly believes that the use of concrete pipe can be further extended by advertising the *uses* of concrete pipe. Their association is carrying forward a series of advertisements in the local construction and engineering magazines showing, not the manufacture of pipe, but its use. When an important job is in progress, interesting features of it are photographed. Spectacular tests showing the strength and durability of concrete pipe are also photographed as, for example, dropping tile from a truck, or subjecting it to extreme pressures by piling pig lead on horizontal sections of the pipe. This association deals primarily with manufacturing engineering, and sales problems.



R. Holt, in charge of production

To meet the growing need for better industrial relations between producers and unions, as well as many other public relations problems, a second concrete products association recently has been formed. It is known as the Associated Concrete Products Manufacturers, Inc., Pacific Northwest. It is headed by Alfred "Pat" Blair who is an attorney with a considerable background in public relations work. Their offices are on the mezzanine floor of the New Washington Hotel, Seattle, Wash. This association will do all the negotiation work with union officials. It may later seek better labor laws for the producers.

The two associations work together in complete harmony. The new group now numbers 65 manufacturing concerns.

Pumice Block

Newer plants in the Northwest, with some exceptions, are comparatively small and will employ in the neighborhood of from five to six men. Their future growth will depend a lot on the growth of the community surrounding them. A good example of the newer plants and companies that will undoubtedly succeed is the Overlake Concrete Products Co., owned co-

(Continued on page 197)

View of Overlake Concrete Products Co. plant and storage yard

Methods and Machines Which Have Cut Large Pipe Costs

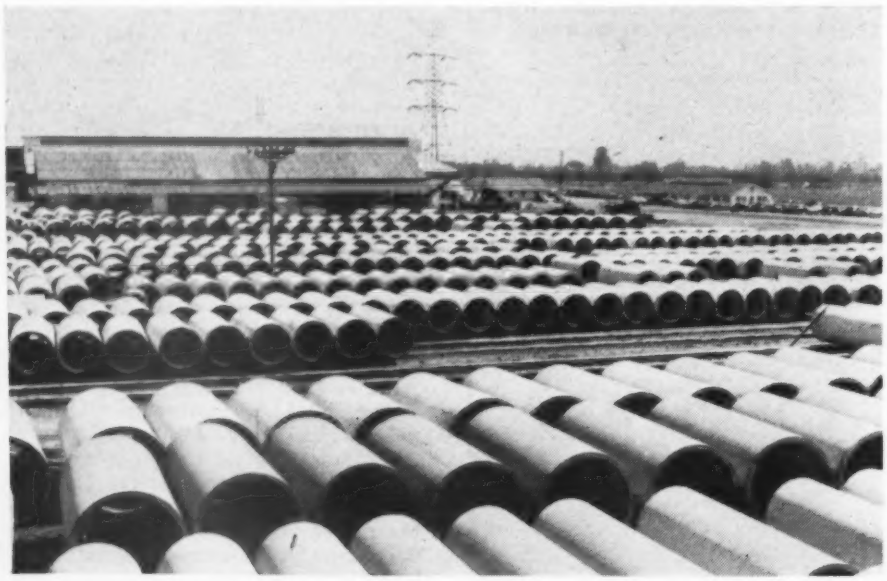
United Concrete Pipe Corporation has contract for 45 miles of large high-pressure water pipe for San Diego, Calif., acqueduct. Make large pipe by both cast and spun processes

By W. B. LENHART

Crane raising 2-cu. yd. bucket of concrete over pipe forms. To the left, may be seen plywood steam curing boxes

FROM ITS very beginning in 1936, the United Concrete Pipe Corporation, Baldwin Hills, Calif., has been making big pipe as well as a complete line of smaller sizes. One of its first large contracts was the casting of the 108-in. diameter reinforced concrete pipe used by the Metropolitan Water District of Los Angeles, Calif.

Early in 1945 the company secured a major portion of the contract for manufacturing, hauling, trenching, laying, testing and refilling large diameter concrete pipe for use on the aqueduct being built from near Hemit, Calif., to San Diego. The total length of this aqueduct is 71.3 miles, and the United Concrete Pipe Co. is supplying about 45 miles of this pipe. The intake of this project is near the west portal of the San Jacinto tunnel on the Metropolitan aqueduct that brings water from the Colorado river into Southern California. The first 2½ miles of pipe is 96 in. in diameter, and is being supplied by the American Pipe and Construction Co. of South Gate, Calif. The contract for the pipe for the next 19.3 miles was sublet to the United Concrete Pipe Corporation. From the 21.9- to 46.8-mile section, this latter company has the entire contract to manufacture and install the pipe. From 46.8- to 71.3-mile section, the S. A. Healy Co., and the American Pipe and Construction Co. have the contract.



Large stockpile of concrete pipe with general view of plant in background

Costing about $18,000,000, the aqueduct will deliver 50,000,000 gal. of water daily to the San Vincente reservoir near San Diego. The work has been planned so that the gallonage can be doubled by laying pipe parallel to the present construction in those sections where trenching is relatively easy, and where trenching can be done without blasting or interfering with the concrete pipe already laid down. Where the terrain is rough and rocky and blasting necessary, present pipe diameters are larger so as to carry the future loads without additions. There are a total of seven tunnels ranging in lengths up to 5700 ft. These are lined with concrete so as to have an I.D. of 6 ft. There are three river crossings, using steel syphons 48 in. in diameter. The total fall is about 1100 ft. with some sections of the pipe designed to withstand 500 ft. of hydrostatic head. Some of the country traversed is relatively flat but most of the area is quite rugged and hilly.

Work was started by the United States Navy, for when the war was pretty well along, the Navy engineers estimated that the Navy was using a larger proportion of the city's water than the citizens. They therefore set about to provide added water for the huge war plants built in San Diego.

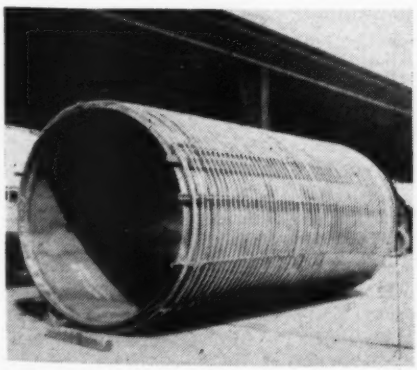
At the conclusion of the war the financial setup was changed so that the city is now planning on repaying the government at the rate of $500,000 per annum, without interest until the cost of the project is repaid. The Navy engineers, however, are still in charge of the inspection and related work on this project. It is expected to be completed about July of this year (1947).

For the section from 21.9 to 46.8 miles, the United Concrete Pipe Corporation will receive $3,585,000 for this work, or roughly $14,340 per mile.

Pipe Specifications

Specifications for the pipe as supplied by the United Concrete Pipe Co. calls for pipe of a nominal diameter of 72, 54 and 48 in. with wall thicknesses of 7½, 6½ and 5¾ in., respectively. The inside diameter must not vary more than 1.5 per cent of the specified nominal diameter, with the average diameter being that specified. The thickness of the walls of the pipe can vary up to 5 per cent of that specified but the average thickness must be that specified. The lengths are specified at 16 ft. Ends of the pipe are made at right angles to the longitudinal axis except where pipe is to be laid on curves. Here the ends may be beveled to provide the required curvature. After the pipe is laid, the maximum offset on the inside of the pipe joint is not more than 5/16 in.

Reinforcing bars can be either plain or deformed; either round, square, or rectangular, although for most of the work round steel is used, especially for the wrappings. As an example of the type of this reinforcing, the illustration shows a 48-in. diameter steel cylinder with its reinforcing. The steel cylinder is of 8-gauge steel plate, butt-welded by automatic electric arc-butt welds in the company's shop. Wound tightly around the steel cylinder is a layer of ⅝-in. round iron on 4-in. centers and an outer cage of



Showing how reinforcing is assembled; ⅝-in. round reinforcing is tightly wrapped around steel on 4-in. centers. Then an outer cage of ¾-in. round steel wire is wound on 4-in. centers and 3 in. from the inner cage. Every 2 ft. around periphery is a ¾-in. length of reinforcing steel, electrically welded to the outer cage, the entire assembly being welded into a very substantial pipe reinforcement

Structure to the rear houses two huge lathes that wind heavy reinforcing on steel cylinders, ready for placing in the forms

¾-in. round steel similarly spaced. Every 2 ft. around the periphery are ¾-in. longitudinal members, all electrically welded together so as to prevent any possibility of deformation in the molds. For making the steel cylinders, the required gauge iron (its gauge depending on the hydrostatic pressures, 6 gauge max., 10 gauge min.) is accurately trimmed to present a true edge for the butt welding. After the first weld they are curved to shape, and the electric welding continued inside and out. In the welding shed there are 18 Lincoln electric welders.

Reinforcing steel wound on the cylinders comes in large coils of several thousand feet each. These coils are placed over a stationary spindle in the yard. The bare steel cylinder is placed in one of two large lathes and the cylinders clamped rigidly in position. As the cylinder revolves in the lathe, the steel reinforcing is wound around the cylinder in such a manner as to be accurately spaced and under proper tension. Reinforcing steel is then electrically spot welded to the cylinder. The outer cage is similarly wound to the steel cylinder and the whole assembly electrically welded. The joint rings are welded to the ends of each steel cylinder.

All of the steel cylinders before placing in the concrete are tested under hydrostatic pressure to insure there are no leaks. (The specifications say: "The finished cylinders with joint rings welded onto each end shall be tested under hydrostatic pressure sufficient to stress the steel to 20,000 p.s.i. . ." All scale, oil or other foreign matter is removed from the cage and cylinder before being encased with concrete.

The joints used are those developed by the American Pipe and Construction Co., consisting of a recessed groove in one end of the steel cylinder. Into this groove fits a circular (cross-section) rubber ring so designed that a lock joint results. Slightly under 25,000 of these joints are provided, and the entire 71.3 mile contract for this alone was in excess of half a million dollars.

How Pipe Is Installed

In laying the pipe, the bell end may be laid with the spigot ends in or against the direction of flow. A band of heavy roofing paper is placed around each joint, held tightly in place, and some back-fill placed around the section. When the back-fill is well towards the top, a 1 to 1 portland cement grout is poured around the joint and rodded into place with a flexible "pig-tail." The pour normally can be around both sides but if the ground is wet the top is divided off and all the grout poured into one side and rodded completely around the pipe.

On the 72-in. pipe two wheelbarrow loads of grout are used for each joint, and the pour is continuous. The top section is kept moist with burlap for three days when backfilling can be completed. Inside joints are filled and tamped with a 1 to 1 grout and trowelled smooth. During this work the ends of the pipe are kept covered during off-work periods so that grout will not dry out prematurely.

From time to time sections of the completed pipe are bulkheaded off and filled with water under pressures not to exceed 25 per cent of the operating head for that particular section. Water pressure is maintained for 24 hours, and the amount of leakage must not exceed 100 gal. per inch of internal diameter per 24 hours. If the leakage exceeds 60 per cent of the maximum permitted, water pressures are maintained for 30 days. All leaks must be caulked and stopped regardless of the amount.

Trucks loaded with pipe waiting to be unloaded; pipe are 72-in. dia., weighing 17 tons

Where trenching is in rock the excavation is carried slightly below the neat line and brought up to grade with compacted dirt fill. Where the excavation is in earthy material the United Concrete Pipe Co. uses a new Austin No. 600 for this work. This machine can dig to such close depth tolerances that little or no compacted refill is needed before the pipe can be laid. The Austin is powered by an RD-8 Caterpillar Diesel unit.

Aggregates and Concrete

Concrete aggregates used are all purchased from the Azusa Rock and Sand Co. plant which was described in the ROCK PRODUCTS, February, 1947, issue. For the 48- and 54-in. pipe ¾-in. aggregate is the maximum allowed, with 1½-in. allowed for the 72-in. pipe. The mix proportions are determined on the basis of producing concrete having good workability, density, impermeability, durability, and with a compressive strength of not less than 4000 p.s.i. compression. The concrete must not exceed a net water-cement ratio of 0.55 by weight, exclusive of that retained in or absorbed by the aggregate. This gives about a 2-in. slump. The maximum allowable water-cement ratio can be reduced if necessary when it is required to produce the specified strengths.

Aggregates are delivered to the Baldwin Park plant by trucks which dump to a hopper. A bucket elevator elevates the materials to bins above. Bins are available for modified portland cement and for the sulphate resisting type. A 2-cu. yd. Koehring mixer discharges to a bottom-dump bucket used for filling the molds.

Pipe Manufacturing Methods

The yard where the pouring is done is arranged in a slight curve alongside standard railroad tracks. Along this track are about 16 banks or nests of forms with eight forms to each nest. The forms are of steel plate with cast steel top and bottom rings; the exterior forms can be expanded to remove, and the interior forms collapsed so as not to endanger the partly cured concrete. The forms must be and are strong enough to carry the load of concrete without deformation. In filling the molds, it is the practice to fill four molds at a time, almost continuously, with a crew of men mounted on top with air rams and vibrators so that the concrete will be free from pockets and fit snugly against all surfaces. One only has to see the excellent pipe in the yard to certify to the effectiveness of this work. About 6 ft. from the bottom of each mold are two heavy-duty, Viber, high-speed vibrators. These vibrators are placed about opposite each other on the outside of the form. When a nest of the forms have been poured a plywood curing shed (or box) that is roughly 30 ft. long, 16 ft. wide, and 20 ft. high is placed over the forms, and the concrete is steamed for not less than six hours with saturated steam so as to produce a curing temperature of not less than 120 deg. F. and not over 150 deg. F. It is the practice to make this preliminary steaming period about 12 to 14 hours long. After this time the forms can be removed. Steaming is then continued in some cases to 72 hours but in no case can the pipe be tipped sooner than 36 hours. In case the pipe is steamed 36 hours only they complete the curing in the yard by keeping the concrete damp for at least seven days.

The bucket used for filling the forms is designed for the operator to ride with the load. An Ohio crane lifts the buckets over the forms for unloading. The same crane can, if desired, also lift the plywood curing boxes on and off the forms. Usually 40 lengths of the 16-ft. pipe are cast per 8-hr. day. Steam is supplied by a 125-hp. Southwestern Engineering Co. boiler that has automatic fuel oil and water pumps. The steam plant is about one year old.

There is a world of details going into the fabrication of concrete pipe for a job such as this, including the welding of steel sleeves for manholes, takeoff, and blowoff nozzles onto the steel cylinders before the concrete is poured, and again after the concrete is cured. These outlet openings must all be placed according to detailed drawings provided by the Navy engineers.

For handling the pipe in the yard there are available six heavy-duty cranes of various kinds. For loading pipe to trucks, a Speedcrane is used, and a Browning crane is also available. For this work a rugged piece of equipment is needed for the 48-, 54- and 72-in. cured pipe weigh 9, 11 and 17 tons, respectively. Pipe are delivered by tractor-trailer trucks to the place of use, an average haul of about 90 miles, the number of pipe per load depending on the size of pipe, two pipe for the smaller diameter and one unit for the larger.

Laying 48-in. pipe behind trench digger. This pipe has 300-ft. head at this point

Also Make Spun Pipe

Besides making large diameter pipe of the kind used on the San Diego aqueduct project, the United Concrete Pipe Co. also makes spun pipe using the Moir-Buchanan process, for which they have exclusive rights in the West. In this process the steel cylinder used for the mold is first coated with about ⅛-in. of paraffin on the inside. This paraffin wax has a melting point of 120 to 128 deg. F. After coating the inside of the form, the paraffine is first poured hot into the form while laid flat, the cylinder then slowly rolled back and forth until the wax congeals on the inner surface of the mold. The reinforcing cages are then placed in position. This assembly

is then placed on the spinning machine and the concrete and forms spun at 2500 lineal feet per min. peripheral speed. This compacts the concrete to a high degree. The form is then placed in the steam kilns and steamed at a low temperature with the heat being gradually increased towards the last of the curing period. This melts the paraffine and it runs out the end of the form into a canal and to a central reclaiming pool where the wax can be re-used. Melting the paraffin frees the concrete pipe sufficiently for it to be lifted (still in the horizontal position) from the mold by a special machine.

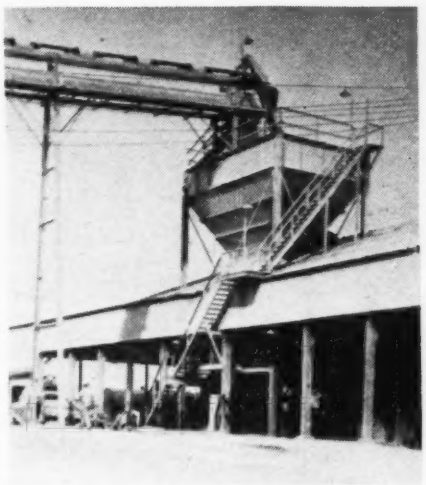
The company has two of the centrifugal machines; one for large diameter pipe (33- to 48-in. pipe) and one for the 18- to 33-in. diameter pipe. Forms are available so that pipe within these ranges with step gradients of 3 in. can be supplied; i.e., 18, 21, 24, 27 in., etc., on up to 48 in. These pipe can be used for internal pressure and other purposes.

This section of the plant, which is separated from the cast pipe section, has its own batching and concrete mixing department. Several types of machines are available for testing the strengths of the spun pipe so that a high quality product is assured.

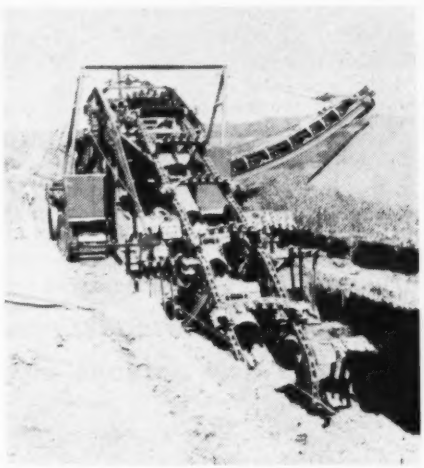
Officers of the United Concrete Pipe Co. are: B. J. Ukropina, president; Steve Kral, and T. B. Polich, vice-presidents. Chris Adzovitch is superintendent of the plant, and H. F. Armstrong has supervision of design and construction.

The headquarters for the engineering staff of the 11th Naval District is at Vista, Calif. Captain A. K. Fogg (CEC) U.S.N., is the officer in charge of construction contracts. Commander R. D. Thorson is senior officer in charge of construction; Lt. Cmdr. F. M. Hines is in charge of the Central Division of United Concrete Pipe Company's contract; A. J. Foreman, senior engineer; H. L. Jones, division engineer, and R. V. Sheriff is chief inspector.

Four aggregate and two cement bins are mounted over 2-cu. yd. mixers



Hoppers over section where spun pipe are made



Trench digger driven by Diesel tractor

Pumice Block

(Continued from page 193)

operatively by the owners of the Lakeside Gravel Co., Bellevue, Wash. Bellevue is a small community on the east side of Lake Washington. It could be called East Seattle. It is connected to the main city by a four-lane concrete auto-way supported by pontoons, and Highway No. 10 routes eastward over it. This section of Seattle is expected to be *the* coming residential section of that fast growing city. Concrete aggregate of glacial origin is plentiful on the east banks of Lake Washington, and several small sand and gravel plants are located along the lake. All these plants have ready mixed concrete units, using bagged cement. Many are planning expansions soon. From north to south there is the Kirkland Sand and Gravel Co., at Kirkland; Cadman Gravel Co., at Redmond; Lakeside Sand and Gravel Co., at Bellevue, and the Stoneway Docks Co., at Renton.

Midway in this group and strategically placed is the Overlake Concrete products Co., with a small block plant that started operating last July. Even though the plant is alongside the sand and gravel operations the producer to date has concentrated exclusively on the production of pumice block. Pumice is shipped in from Morton, east of the Cascade Mountains. "INSUL" block is the trade name given this company's products. Starting off with a small Fiam, hand-operated machine, the company just recently installed a second larger Fiam unit. This latter machine makes three 8- x 8- x 16-in. block or six 6- x 6- x 12-in. block. This latter size is the favorite in the vicinity. An Ace tile machine and a roofing tile unit also are being installed, and steam kilns will be completed shortly. A Mobil-lift or Mighty-Miget is used for transporting block to the curing yards.

R. Holt, an ex-service man who saw service in the European theater, is in charge of production and personnel. He is enthusiastic and anxious to learn his new work. With its favored location and favorable start it should continue to grow and expand its manufacturing facilities. Troy Milliken is one of the owners and acts as manager.

Patented Septic Tank Uses Concrete Block

PETER NEWBERG, Eagle Lake, Minn., has received approval from the United States Patent Office on a new septic tank design that has been the subject of experiments over a ten-year period. The tank may be built in any desired size and can be constructed with concrete block or brick rather than steel. The new design incorporates but one tank instead of several.

Atomic Bomb Staff Chooses Pumice Block

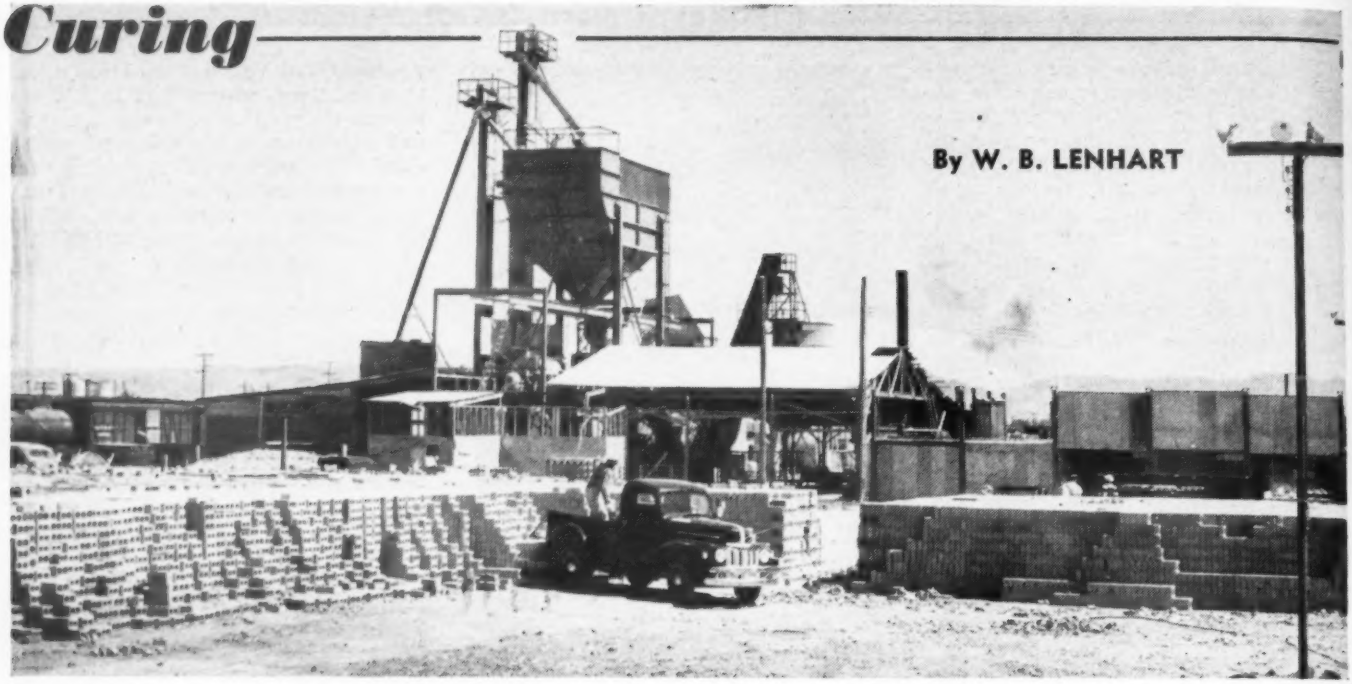
F. W. HEATON, president, Pumice Mfg. Co., Inc., Albuquerque, N. M., has announced that his company will supply 200,000 pumice blocks (8- x 8- x 16-in.) for local airport construction. The new building will provide headquarters for the Atomic Bomb Staff.

Ready-Mix Unit Added To Concrete Plant

A READY-MIX CONCRETE PLANT has been added to Bladsolm Brothers Co., Marshall, Minn., producers of concrete culvert. Delivery of concrete will be made in a radius of 15 miles from the plant.

Off Export List

ANNOUNCEMENT has been made by the U. S. Department of Commerce that concrete block machinery was taken off of export licensing control along with many other items.



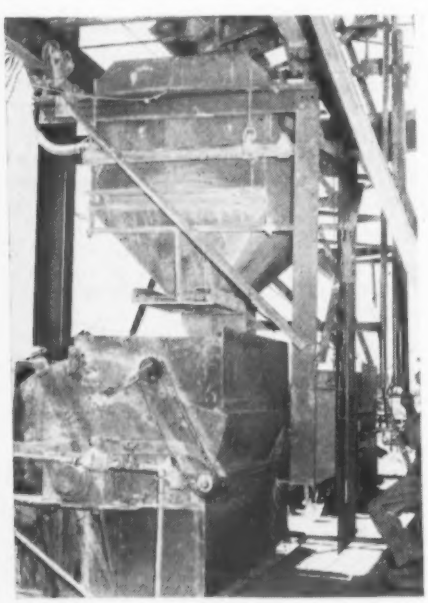
By W. B. LENHART

View of plant showing concrete block and brick storage, steam curing room, and to the left, aggregates hoppers with overhead track below for traveling weigh batcher

Steam Plus Hot Air For "Preshrinking"

Builder's Supply Co., Phoenix, Ariz., makes its own perlite aggregate. Experiments with new haulage methods

ONE of the largest producers of concrete masonry units in the Southwest is the Builder's Supply Co., Phoenix, Ariz. This progressive concern had two block plants but recently concentrated all manufacturing operations at its plant in Six Points, a suburb of Phoenix in the northwestern part of the city. About $100,000 was spent modernizing the Six Points plant and rebuilding its perlite exfoliation plant. If this company has to yield second place to a larger producer in quantity, it will still be among the leaders as to production of a quality product, and in pioneering new ideas and methods that will reflect benefits to the entire concrete masonry industry.



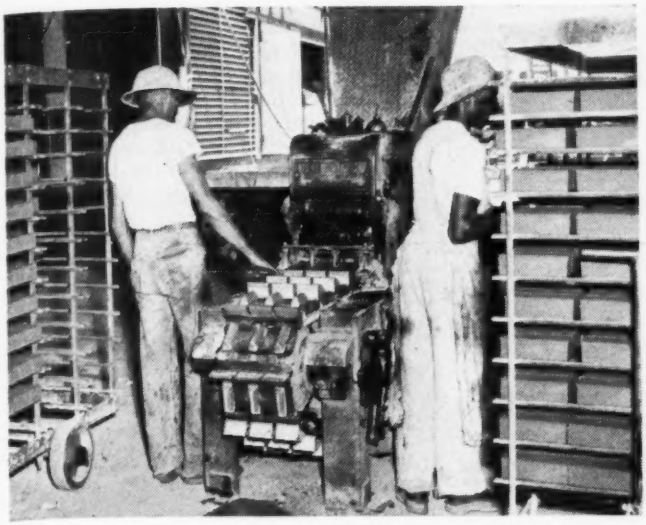
Operator at controls of traveling weigh batcher dumping into one of the mixers above block and brick machines

As an illustration of this pioneering; the problem of loading concrete blocks onto trucks has been more or less solved by the use of high-lift pronged trucks but the unloading of the bricks from trucks is still a high labor cost. This company is experimenting with the use of "straddle" carriers so commonly used by the lumber industry. It also is going to deliver all its output for one week by means of Ross carriers. The blocks will be piled in a uniform manner, with pipes inserted in the block openings in such a manner that the straddle truck will lift the entire load and deliver it on the job. In cooperation with the manufacturers of this type of haulage equipment, the block manufacturing company hopes to work out a practical solution of block transportation. Another plan is to use rubber compression members along the side of a pile of blocks so designed that when the rubber blocks are pressed against the concrete blocks they can be lifted and transported to place of use.

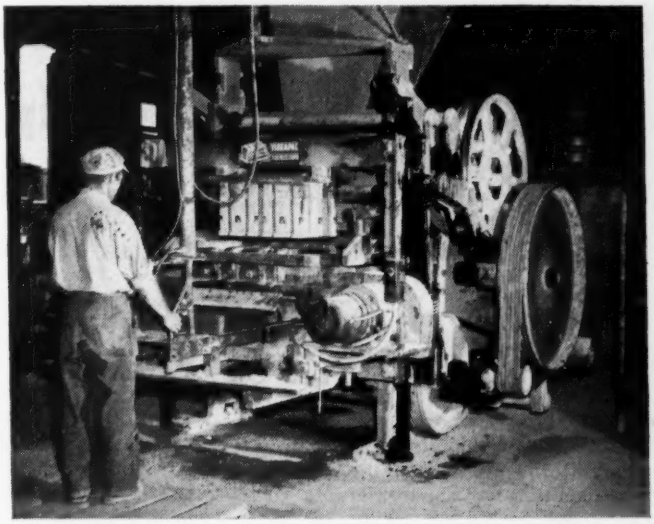
Perlite Aggregates Plant

A second pioneering venture undertaken by this company is intended to evolve a method of eliminating small cracks in the joints of the blocks after being set in mortar. It has often been noticed that some blocks will show a very thin hair-line crack in the mortar joint. This, the officers of the Builder's Supply Co. believe, is partially due to shrinkage of the blocks after being placed. A series of tests are being carried out to preshrink the block before it goes to the block plant storage yard. To do this, four of the smaller steam kilns have been assigned to experiments whereby the blocks are first steam cured and then dry hot air is rapidly circulated through the steam kiln. The time for steaming is normally 8 hours, and it is expected that two hours of dry heat at 175 to 180 deg. F. will do the trick. These experimental kilns are provided with a dry air heater, natural gas fired, with one of these heaters serving two kilns. The company has nine kilns in all; six kilns 12- x 50-ft., and three new kilns 12- x 80-ft. long. Steam for the kilns is supplied by a James Leffel & Co. boiler or from the perlite plant.

The company, along with the Great



One of two high-capacity block machines



Concrete brick are made in large volume on this machine

Lakes Carbon Co., has pioneered the processing of perlite, the lightweight aggregate. Perlite is a volcanic rock containing some water. When the material is heated to high temperatures, the material expands so that the resulting product will weigh from 12 to 14 lb. per cu. ft. As there are huge deposits, cheaply mined by open pit methods at Superior, Ariz. (a short rail haul east of Phoenix) this material is much in the minds of block producers in the Southwest. The original perlite plant had a capacity of 2000 cu. ft. per day of expanded material, and it has been replaced by a new unit of double that capacity.

In heating the crude, crushed and sized perlite in the older plant about 1000 cu. ft. of natural gas per day is used. Two short rotary kilns are used, one acting as a pre-heater. Temperatures carried in the second kiln are relatively high. It has been found advantageous to preheat the crude perlite for too sudden a heat explodes the material and produces too much fines. By regulating the temperatures in the pre-heater, an almost sized final product can be obtained.

Experiment with Mixture of Volcanic Cinders and Perlite

Concrete block made on the Besser machine shows compression strengths in excess of 900 lbs.—the minimum code requirements for Phoenix. As the concrete block made from this aggregate weigh 53 to 55 lbs. per cu. ft., they are light enough to float on water. They also show excellent heat and sound insulation properties. This company has built its new perlite plant so that a belt conveyor delivers the material to a steel hopper from which it is elevated to steel bins over the Besser and Dunbrik mixers. Two 50 cu. ft. Besser mixers and one 25 cu. ft. Dunbrik mixer are operated. Air conveying has been found unsatisfactory for handling finished perlite as the material is too abrasive.

Another departure from standard practice that this company is entertaining is the use of volcanic cinders and expanded perlite for production of a new type of block. North of Phoenix are large deposits of a red to black colored volcanic cinder that for the most part could be considered a lightweight aggregate. However, this company has found that the fines in the cinders weigh too much so they are preparing blocks using perlite for the fines and volcanic cinders for the coarse aggregate. The resulting block is stronger and costs less. Volcanic cinders unloaded north of the plant are placed into the previously mentioned steel hopper by a belt conveyor.

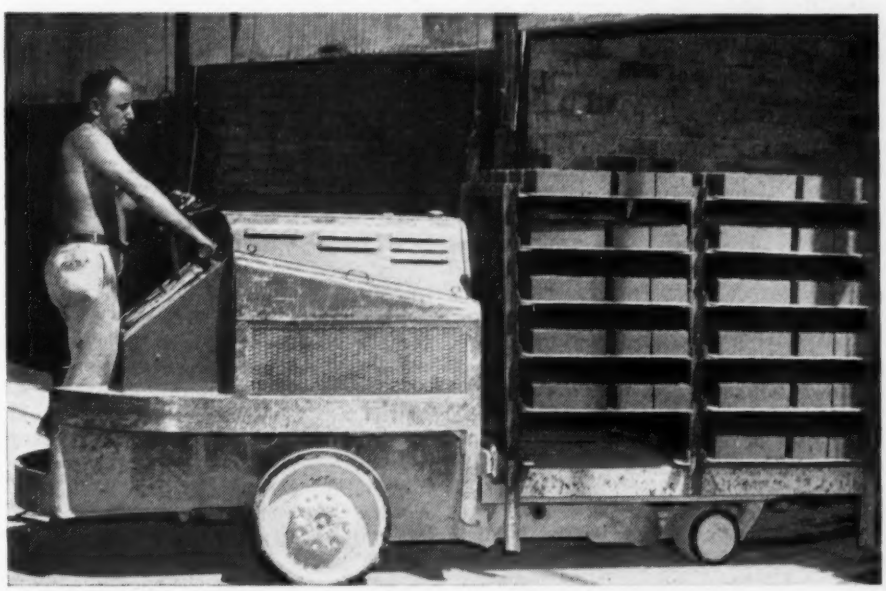
At the perlite plant, which operates on a 24 hr. basis due to heat economies, it was found that a considerable amount of heat was lost in the stack. A waste heat boiler built around this stack develops enough steam to run the curing kilns.

Crude perlite, coming into the plant sized to about minus 6-mesh, is elevated to the top of the plant and passes over a vibrating or "flotation table." This table receives about 20,000 vibrating impulses per minute. Due to the vibration there is a segregation of materials of different specific gravities, and as a result of the nature of the vibration, each material (of same specific gravity) is carried off the table in a different direction. The table, made by Steele, Sutton and Steele, removes any rock materials that will not expand such as quartz, etc. The cleaned crude perlite then passes to a steel bin from which it is fed to the rotary kiln by a Syntron automatic feeder.

Block Manufacturing

In the block plant all hard aggregates are delivered to the steel hopper for delivery by trucks, previously mentioned. The different products are all elevated separately to a 4-compartment steel bin which has a capacity of 440 tons. A bulk cement silo is also available. Cement, delivered to the

(Continued on page 204)



Low-lift trucks moving concrete brick to steam curing rooms

Labor Requirements Data For Concrete Pipe

A study of the concrete pipe industry by the U. S. Dept. of Labor

By ALFRED W. COLLIER* and CLYDE STONE*

TODAY there are approximately 300 concrete pipe manufacturers in the country, 150 of which manufacture pipe exclusively. The remaining producers manufacture concrete products such as blocks, brick, etc., in addition to pipe. Most of these manufacturers are small and employ an average of 6 to 10 workers. A few large producers in the United States employ up to 200 men. These are principally multi-plant organizations which started temporary plants on job sites. Because of the extreme weight and bulk of the product, transportation is a major item of expense, and to move a plant to the construction site proved to be more economical than transporting finished pipe from distant established plants. When construction on the job was completed the plants continued operations to serve local needs.

The following approximate production figures were obtained from industry representatives:

1942	4,000,000 tons
1943	2,000,000 tons
1944	741,000 tons
1945 (estimated)	721,000 tons
1946 (estimated)	705,000 tons

Made in sizes from 4 in. in diameter to 138 in. in diameter, in both plain and reinforced concrete, it can be designed to serve a variety of internal pressures and external loading conditions. These sizes and designs are made by a variety of means.

Represented in this study are all sizes of concrete pipe, both plain and reinforced. Separate analysis for the various sizes and the plain and reinforced pipe was not considered feasible. Because of the range in sizes and the special purposes for which pipe may be used, the production equivalent is in net tons of product manufactured.

Man-Hour Requirements

The analysis of 34 plants included in this study indicates that a total of 7.50 man-hours was required for the production of one ton of concrete pipe. It was estimated that 2.63 man-hours were required to extract, process, and deliver to the plant the necessary materials (including electric power) for the production of one ton of concrete pipe. Plant operations accounted for 4.40 man-hours per ton and the transportation of the finished product to the construction site required 0.47 man-hour. A summary of these operations is presented in the following table:

	Man-hours per ton of concrete pipe
Raw materials, production and transportation	2.63
Manufacturing	4.40
Transportation, finished product	.47
Total	7.50

In manufacturing operations, man-hour requirements in the production of one ton of pipe varied inversely with the monthly rate of production. Plants producing 500 tons or less per month required 6.48 man-hours per ton, while the labor requirements per ton in plants producing more than 1400 tons per month were 3.93 man-hours. Variations were noted among geographic areas with requirements ranging from 4.00 man-hours for plants in the Pacific States to 6.16 man-hours for plants in the Northeast.

Production and Transportation of Raw Materials

The principal materials used in the manufacture of concrete pipe are (1) cement, (2) sand and gravel or crushed stone, and (3) reinforcing steel. In the following table are listed those materials, including electric power, and the man-hours required to produce the quantities consumed per ton of concrete pipe, for which data were estimated:

Material	Amounts required per ton	Man-hours required to produce quantities consumed per ton[1]
Total		2.63
Cement (barrels)	0.90	0.90
Sand and gravel (tons)	.85	.80
Reinforcing steel (tons)	.02	.91
Electric power (kw.-hr.)	6.03	.02

[1] Includes man-hour requirements for delivery to the plant.

In 1945-46 the man-hour requirements for the production and transportation of 100 bbls. of cement were 100.49, and 3.12 man-hours were required to produce 1000 kw. hr. of electric power. In the manufacture of one ton of concrete pipe it was determined from these figures that the labor requirements were 0.90 man-hour for the 0.90 bbl. of cement used, and 0.02 man-hour was expended in providing the 0.2 kw. hr. of electric power consumed.

The production and distribution of one ton of sand and gravel required an average of 0.945 man-hour in 1937. In the absence of information for the current period, these data were used as a basis for estimating the labor requirements for sand and gravel. It was therefore estimated that 0.80 man-hour was needed for the production and transportation of the 0.85 ton of sand and gravel used in the production of one ton of pipe. While crushed stone is important as an aggregate in the concrete pipe industry, sand and gravel is considered as representative of the aggregates used in the production of pipe.

An analysis, in 1935, of man-hours per unit in steel manufacture did not prepare estimates for the manufacture of the type of steel used as reinforcing for pipe. However, in the absence of these data, the man-hour requirements for drawn wire were substituted. Thus it was estimated that 0.91 man-hours were required to produce and transport the average quantity of reinforcing steel used in the manufacture of one ton of concrete pipe. It should be noted that the 0.02 ton of steel represents an average requirement per ton for the production of all plain and reinforced pipe included in this study, and that the labor requirements estimate does not include the fabrication of this material into the steel fabric used for reinforcing.

Manufacturing-Plant Operations

Because the pipe plants included in the study manufactured a wide variety of sizes during the period surveyed, it was found feasible not to attempt to separate the manufacturing process in terms of man-hours for machine-molded and hand cast pipe.

The following table shows the man-hours required to manufacture a ton of pipe by plant operations. A total of 129,370 man-hours of labor was required to produce 29,402 tons of pipe, or 4.40 man-hours per ton.

	Total Man-Hours	Man-Hours Per Ton
Total (34 plants)	129,370	4.40
Proportioning and mixing	12,251	.42
Cage welders	7,484	.25
Molding (machine and cast)	13,017	.44
Trucking and stripping	17,848	.61
Yard	41,201	1.41
Maintenance	9,783	.33
Superintendents and foremen	8,757	.30
Miscellaneous labor	2,492	.08
Administrative	16,538	.56

*Bureau of Labor Statistics, U. S. Department of Labor.

The first operation, proportioning and mixing the cement and aggregates before the pipe is molded, required 0.42 man-hour per ton. The construction of the steel reinforcing cage, around which the concrete is poured for the larger sizes of pipe, comprises the cage welding operation. This required 7,484 man-hours for the 34 plants surveyed, or 0.25 man-hour per ton.

The molding operation, including pouring concrete into forms, and vibrating or tamping, expended 13,017 man-hours, or 0.44 man-hour per ton of pipe produced.

After the pipe is formed or molded, the next operation is stripping the unit from the mold. For machine-molded pipe, this is done by mechanical strippers which remove the mold and allow the pipe to stand and harden. Then the unit is placed on carts or dollies and hauled to the curing rooms or kilns. In cast pipe the mold is removed by hand and made ready for wrapping and sprinkling. A total of 17,847 man-hours was required in all plants for this operation, or 0.61 man-hour per ton.

Because pipe is bulky and heavy, considerable yard labor is necessary to move the pipe from the molding forms to curing places about the plant. After curing, the pipe is prepared for shipment. In cast pipe plants, yard men assist in stripping the mold and wrapping the pipe. This operation accounts for nearly a third of all labor in the plant. The yard operations required 41,201 man-hours, or 1.41 hours per ton of concrete pipe.

Overhead operations, including maintenance, superintendents and foremen, miscellaneous labor, and administrative labor, required 1.27 man-hours, or about 30 per cent of total requirements for plant operations.

Transportation of Concrete Pipe

Wide dispersal of concrete pipe plants is made necessary because of high transportation costs for the finished product. Concrete pipe may be delivered to the point of use by the manufacturer or by trucking companies on a contract basis. Since considerable proportions are also transported from the plant by the purchaser, the data for the transportation of pipe to the construction site are not included in plant operations. Data for plants which delivered their product show that the transportation of 17,333 tons of concrete pipe required 8,071 man-hours, an average of 0.47 man-hour per ton.

Variations in Labor Requirements By Monthly Rate of Production

Table 1 indicates the variations in man-hours per ton of pipe production on a monthly tonnage basis for 29 of the 34 plants included in the survey. Considerable variation was noted between those plants which produced 1400 tons and over per month and those producing less than 500 tons during the same period. The man-hour requirements are shown for the general classifications of manufacturing, yard, overhead, and administrative operations.

The average for all plants was 4.55 man-hours per ton, the largest manufacturers required 3.93 man-hours for each ton of pipe produced, while the small plants required 6.48 man-hours.

Table 1: Average Number of Man-Hours Required to Produce One Ton of Concrete Pipe, 1946, by Rate of Production[1]

Monthly Production	No. of Plants	Man-Hours per Ton: Total	Manufacturing	Yard	Overhead	Administrative
All Plants	29	4.55	1.73	1.50	.73	.59
Under 500 tons	8	6.48	2.18	2.22	.87	1.21
500 through 799	8	4.77	1.82	1.35	.90	.70
800 through 1099	5	4.34	1.93	.95	.85	.61
1100 through 1399	5	4.24	1.57	1.62	.63	.42
1400 and over	3	3.93	1.40	1.72	.47	.34

[1] Excludes transportation of finished pipe.

Table 2: Average Number of Man-Hours Required to Produce One Ton of Concrete Pipe, 1946, by Geographic Division[1]

Area	Number of Plants	Man-Hours per Ton: Total	Manufacturing	Yard	Overhead	Administrative
All Plants	34	4.40	1.72	1.41	0.71	0.56
Pacific	6	4.00	2.13	.68	.75	.44
East North Central	10	4.01	1.40	1.44	.61	.56
Middle Atlantic	8	4.20	1.12	1.91	.51	.66
West North Central	3	4.34	1.81	1.35	.79	.39
South	4	4.74	2.30	1.29	.72	.43
Northeast	3	6.16	2.56	1.34	1.39	.87

[1] Excludes transportation of finished pipe.

Variations in the labor requirements per ton of pipe by geographic areas are presented in Table 2. Total man-hour requirements per ton range from 4.00 for plants in the Pacific States to 6.16 for plants in the Northeast. It is not to be concluded that these variations assume significance because of the geographic location of the plants. The comparatively high averages shown for the Northeast appear to be largely due to the low percentage of capacity utilization in the plants of that area. This factor is significantly reflected in the man-hour requirements for the overhead and administrative functions. It should be noted that the plants, in the areas showing man-hour requirements below the average for all plants, were producing larger proportions of pipe in the smaller sizes, which permitted the use of pipe molding machines and did not require the extra employment for welding and placing the reinforcing steel necessary in the production of larger sizes. It can be observed that the average requirements for all areas except the Northeast, representing 31 of the 34 plants, are within the relatively narrow range from 4.00 to 4.74 man-hours per ton.

H. G. PAGE, Poughkeepsie, N. Y., manufactures concrete blocks which he retails in conjunction with a complete line of building supplies. Concrete block represents about 25 per cent of the firm's total volume of business. The company maintains four trucks for delivery of all materials it handles.

Washington Concrete Pipe And Products Meeting

HELD at the Harrison Hot Springs Hotel, B. C., Canada, the weekend of June 14, Concrete Pipe and Products Association's 18th Annual meeting was both a business and a social success. The business meeting, presided over by F. M. Kettenring, discussed a large number of topics—all of prime importance to the concrete products field. Among more important subjects under discussion were advertising and promotional activities; public and labor relations; grading of materials, reinforcing screen mesh and the manufacture of concrete products; sound penetration tests on concrete masonry; state highway culvert pipe tests; sand bearing and 3-edge tests on large culvert pipe.

The second day of the meeting was spent in enjoying accommodations at the hotel: tennis, golf, swimming, lawn bowling and badminton. A total of 46 active members were in attendance at the two-day meeting.

Highlighting the business meeting, George Duecy, Associated Sand and Gravel Co., Everett, presented ten applications for membership to the group. Four were from companies in Seattle, two each from Tacoma and Spokane, and one each from Kennewick and Puyallup.

The following officers were elected for the coming year: Thomas P. Nash, president, Bellingham Builders Supply Co., Bellingham; George Duecy, vice-president; A. B. Metcalf, secretary-treasurer, Columbia Concrete Pipe Co., Wenatchee. The retiring officers, F. M. Kettenring, Seattle; J. R. Sherman, Yakima, and W. S. Wilson, Olympia, were given a vote of thanks for their very effective work during the past three years.

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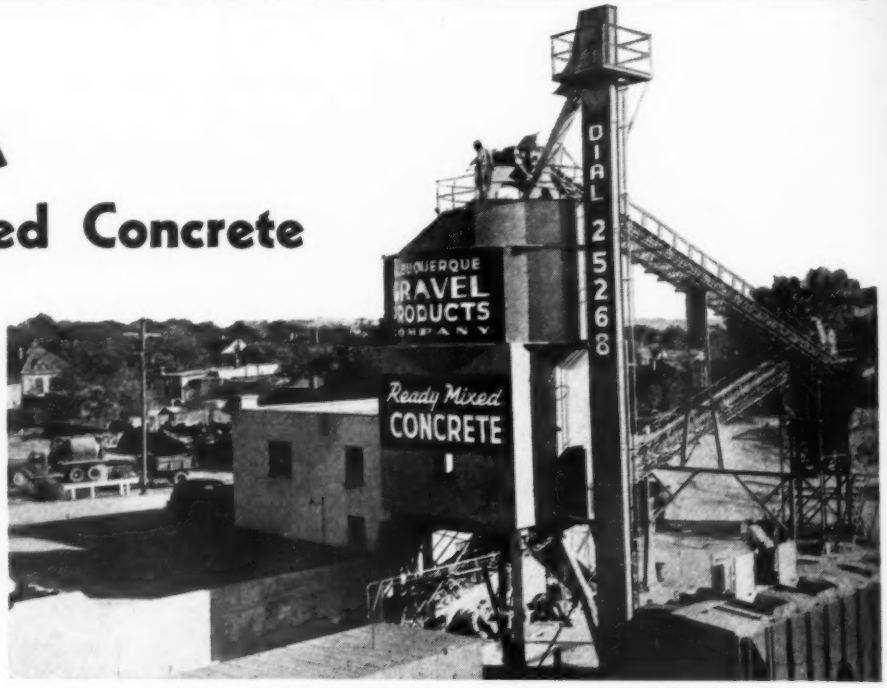
ROY F. HEISER, North Bend, Oregon, is planning to build a concrete block plant.

GRAND OPERA Sells Ready Mixed Concrete

By W. B. LENHART

Albuquerque Gravel Products Co. uses radio and newspaper promotion to sell ready mixed concrete. Produces its own sand and gravel aggregates



Overall view of ready mixed concrete batching plant. Mixer trucks are loaded in the center foreground. Bulk cement cars may be seen to the right

GRAND OPERA and concrete is a combination that most ready mixed concrete producers will find hard to correlate when the industry's usual dissonance is considered. Mixing concrete is becoming an exact science, but at the Albuquerque Gravel Products Co. plant at Albuquerque, New Mexico, science and art have combined. Science has provided the company with a most modern ready mixed batching plant for the production of high quality concrete, and art, in the form of grand opera programs broadcast over the radio, helps sell the concrete.

Eugene Sundt, vice-president of the Albuquerque Gravel Products Co., is an unassuming young man but is also an aggressive and advertising-minded executive. If an idea has reasonable merit he is ready and willing to back it with his resources and give it a trial.

Albuquerque with a population of about 80,000, is a fast growing community. A high proportion of the population is of Mexican extraction. Prior to the advent of the Albuquerque Gravel Products Co. into the ready mixed concrete field there was one older producer in the area. Under such population and competitive conditions the best bet was to emphasize *service* and *quality*, and what was most important, to extend the use of ready mixed concrete throughout New Mexico. "That's all I have to offer," said Mr. Sundt, "just service and quality."

Mixer truck leaving batching plant. In the foreground, extending to one side of platform, is pipe for water supply

Quality can often be a mis-used word, or used lightly and can cover a wide and indefinite field. It's a matter of degree, or that to which one has been accustomed. A Mexican laborer may rightly think that the mud he uses for laying adobe brick is a high quality cement, so it is often necessary to start from scratch and tell the buyers exactly what he refers to when he says "High Quality Concrete."

Possibly Mr. Sundt had some such thoughts in mind, or possibly it was a part of the service he renders to contractors and architects for when we were discussing publicity and merchandising of ready mixed concrete, Mr. Sundt quickly collected from convenient files a small suitcase full of reprints of technical publications, scientific abstracts, and some of his own publicity bulletins. These data started with a "Concrete Primer" and ended with a wealth of technical discussions on practically all phases of concrete; air entrainment, densifiers, dispersing agents, and advantages of Pozzolith. If one digested all the technical information that Mr. Sundt hands out to architects, contractors, or to anyone interested, they could put out their shingle as a "consulting concrete engineer" should they so desire. Following the literature relating to *quality*, out came a slide rule or "Concrete Quality Calculator"—a handy little gadget that enables one to quickly determine the *quantiity* needed of the *quality* product. It was made by the Slide Rule and Scale Engineering Co., and was suitably stenciled with the Albuquerque Gravel Products Company's name.

One may have the best ready mixed concrete in the world, but if you don't tell prospective buyers about it, it may remain yours forever. Mr. Sundt tells part of his story over the local KGGM radio station. This station is at present a 1000-watt unit but is soon to be increased to 5000 watts so his program will be reaching a very wide area. Naturally such a powerful station reaches far beyond the delivery radius of the Albuquerque Gravel Products Co., but that is not too important to Mr. Sundt. His basic idea is to keep his company's name before the public; to educate them in the advantages and convenience and value of ready mixed concrete.

The company's plant is almost in the heart of downtown Albuquerque. One of the latest Blaw-Knox 4½-cu. yd. batching plants, using automatic controls on cement and manual aggregate weighing, has been installed. This new plant and a fleet of Jaeger and Rex mixer trucks round out the major items of equipment. The fleet of 12 mixer trucks is well balanced for large or small deliveries with three 4-cu. yd., five 4½-cu. yd., and two 2-cu. yd. Jaegers and three 4-cu. yd. Rex mixers mounted on 10 International, two Mack and one White truck chassis. The batching assembly includes two Master Builders Co. Pozzolith dispensers for accurately con-

trolling the amounts of the admixtures used.

Use Radio-Newspaper Advertising

With such a neat and orderly plant for economical production of a high quality ready mixed concrete product, the next problem was to sell sufficient concrete to keep the plant busy. Mr. Sundt called in the advertising agency, Bissell-Kutnewsky of Albuquerque, and an advertising program was laid out. Opening day at the new plant, about four months ago, was made into a gala event. In addition to newspaper advertisements, the editorial columns are used to sell concrete. Displays at local meetings, at the Chamber of Commerce, etc., are not overlooked. This advertising program is high-lighted by the use of radio. A year's trial of radio broadcasting has been decided on. To date (April 29, 1947) the program has been on the air ten weeks. The program is called "Favorite Arias from Famous Operas" and is a recording. The company, so far, cannot attribute any of its recent sales directly to the radio advertising, but they have been encouraged to continue its programs because of the many complimentary letters and postcards received. This half-hour program, on the air every Saturday night (7:00 to 7:30 p.m., Mountain Time), not only provides high-class entertainment but also is very educational. Each week a new "commercial" is whipped up by the advertising agency and the listeners learn in 60 seconds of understandable language of air-entrainment, dispersion, Pozzolith, as well as the convenience and advantages of ready mixed concrete. Through Mr. Sundt, the people of Albuquerque are ready mixed concrete conscious. He is doing an excellent job for the industry as a whole. The cost of such a program is about $250 per month.

A typical program was the one broadcast on April 1, 1947. The first announcement on the program was a simple statement, "The Albuquerque Gravel Products Company presents 'Favorite Arias from Famous Operas.'"

The announcer then followed with a brief description of the plot and music of the opera Faust. The company's narrator, Walter Peterson, soon took over, elaborating somewhat on the underlying theme of the opera. After the listeners have heard two of the opera's arias, "O Merveille" and "Dio Possente," the first "commercial" is broadcast by the narrator. It was as follows:

"For many years it has been known that cement, in mixing, flocculates or forms clumps which makes it only about fifty per cent useful. To understand this more clearly take a glass of water and drop a small amount of talcum powder in it. Notice how it draws together in a little ball; this is flocculation. This action—occurring in the mixing of concrete means that it requires about fifty per cent more cement for a specific job, but even more important, it weakens the strength of the concrete, as some of the water, sand and aggregate will not be thoroughly mixed with the cement which is the glueing agent. With the knowledge of flocculation action in concrete mixing, scientists set out to find an antidote for it. The answer was dispersion. . . . The breaking up of the particles so that the cement would mix thoroughly and evenly throughout the water, sand and aggregate. Continued research brought forth a product known as Pozzolith, the world's finest dispersing agent—a product of Master Builders. Pozzolith not only thoroughly breaks up the flocculation but at the same time acts as an air-entrainment agent which greatly increases the durability of concrete. Albuquerque Gravel Products Company is the exclusive agent in Albuquerque for Pozzolith — the world's finest dispersing agent. That is *one* reason why when you *buy* ready mixed concrete from Albuquerque Gravel Products Company you get better, more durable concrete at less money."

Following this 60-second commercial, Mr. Peterson, the narrator, introduces the next two numbers from the opera Faust; "Le Veau D'or," and "Salut, demeure" at the conclusion of which he gives his second commercial lasting about 30 seconds. This time he says:

"The Albuquerque Gravel Products Company produces the only washed sand and aggregate in the Albuquerque area. This is an extremely important factor as washing eliminates most of the impurities that have a tendency to weaken concrete. By using washed plaster or mortar sand you save plaster and cement and you have better results by eliminating premature disintegration. When you need gravel or sand for a driveway, curbstone, or for any other construction need, insist upon washed sand and gravel from the Albuquerque Gravel Products Company. It saves money and gives better service."

Mr. Peterson then introduces the operatic colorature arias "Air des Bijoux" and "The Soldiers' Chorus" concluding with "The Ballet." The closing commercial was as follows:

"The Albuquerque Gravel Products Company welcomes your request for the favorite arias from famous operas, just drop a penny postcard to "Favorite Arias from Famous Operas," care of this station. Next week we present, by request, the favorite arias from "The Tales of Hoffman." And remember, that ready mixed concrete gets the job done better and quicker. It's the modern way of bringing concrete users scientifically mixed concrete for lasting strength and it's more economical. Quality concrete in any quantity from Albuquerque Gravel Products Company, Phone 2-5268."

Each week about 600 printed postcards are sent out to all the architects and contractors in the area calling their attention to next week's broadcast. This advertising and promotional work has kept the mixer trucks rolling and the sand and gravel plant, lo-

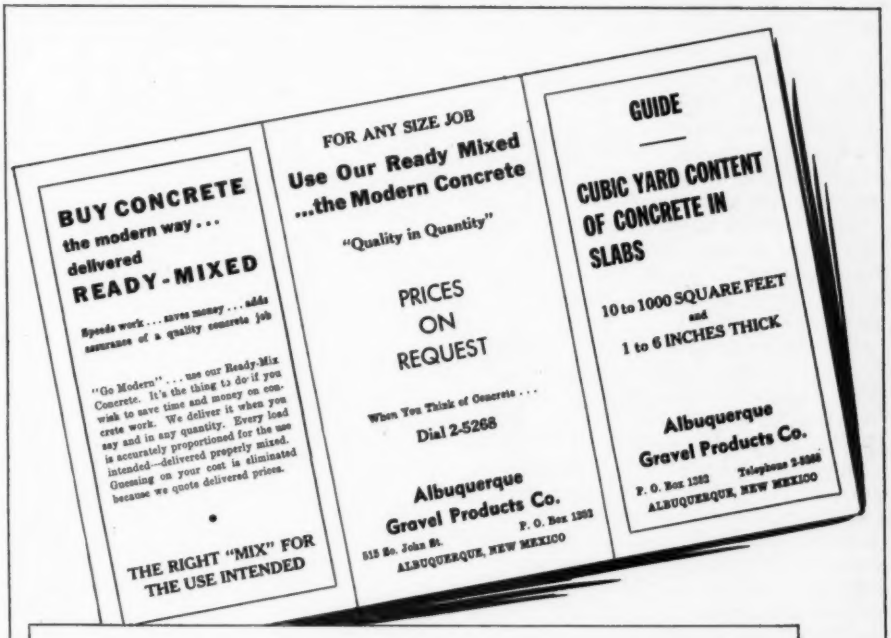

BUY CONCRETE
the modern way . . .
delivered
READY-MIXED
Speeds work . . . saves money . . . adds assurance of a quality concrete job
"Go Modern" . . . use our Ready-Mix Concrete. It's the thing to do if you wish to save time and money on concrete work. We deliver it when you say and in any quantity. Every load is accurately proportioned for the use intended—delivered properly mixed. Guessing on your cost is eliminated because we quote delivered prices.
THE RIGHT "MIX" FOR THE USE INTENDED
FOR ANY SIZE JOB
Use Our Ready Mixed
...the Modern Concrete
"Quality in Quantity"
PRICES
ON
REQUEST
When You Think of Concrete . . .
Dial 2-5268
Albuquerque
Gravel Products Co.
515 So. John St.
P. O. Box 1202
ALBUQUERQUE, NEW MEXICO
GUIDE
CUBIC YARD CONTENT OF CONCRETE IN SLABS
10 to 1000 SQUARE FEET
and
1 to 6 INCHES THICK
Albuquerque
Gravel Products Co.
P. O. Box 1202
Telephone 2-5268
ALBUQUERQUE, NEW MEXICO

TABLE OF CUBIC YARDS OF CONCRETE IN SLABS OF VARIOUS THICKNESSES

AREA Sq. Ft.	THICKNESS OF SLABS IN INCHES										
	1.0"	1.5"	2.0"	2.5"	3.0"	3.5"	4.0"	4.5"	5.0"	5.5"	6.0"
10	.03	.05	.06	.08	.09	.11	.13	.14	.15	.17	.19
20	.06	.09	.12	.16	.19	.22	.25	.28	.31	.34	.37
30	.09	.14	.19	.23	.28	.33	.37	.42	.46	.51	.56
40	.12	.19	.25	.31	.37	.43	.50	.56	.62	.68	.74
50	.15	.23	.31	.39	.46	.54	.62	.70	.77	.85	.93
60	.19	.28	.37	.46	.56	.65	.74	.83	.93	1.02	1.11
70	.22	.32	.43	.54	.65	.76	.87	.97	1.08	1.19	1.30
80	.25	.37	.49	.62	.74	.87	1.00	1.11	1.24	1.36	1.48
90	.28	.42	.56	.70	.84	.97	1.11	1.25	1.39	1.53	1.67
100	.31	.46	.62	.78	.93	1.08	1.24	1.39	1.55	1.70	1.85
200	.62	.93	1.23	1.54	1.85	2.16	2.47	2.78	3.09	3.40	3.70
300	.93	1.39	1.85	2.32	2.78	3.24	3.70	4.17	4.63	5.10	5.56
400	1.23	1.83	2.47	3.10	3.70	4.32	4.94	5.56	6.17	6.79	7.41
500	1.54	2.32	3.09	3.86	4.63	5.40	6.17	7.00	7.72	8.49	9.26
600	1.85	2.78	3.70	4.63	5.56	6.48	7.41	8.33	9.26	10.19	11.11
700	2.16	3.24	4.32	5.40	6.48	7.56	8.64	9.72	10.80	11.88	12.96
800	2.47	3.70	4.94	6.20	7.41	8.64	9.88	11.11	12.35	13.58	14.82
900	2.78	4.17	5.56	6.95	8.33	9.72	11.11	12.50	13.89	15.28	16.67
1000	3.09	4.63	6.17	7.72	9.26	10.80	12.35	13.89	15.43	16.98	18.52

DIAL 2-5268 TO PLACE YOUR ORDER

Guide for calculating amount of concrete required. Above is the outside of folder, and below is the table showing cubic yards of concrete in slabs for various thicknesses

cated a few miles south of the city, working to capacity. This compact but efficient plant turns out about 500 cu. yd. per day of washed sand and gravel. Equipment includes: 16- x 36-in. Diamond primary crusher and a four-deck, wet, Cedarapids vibrating screen. Two 14-in. by 12-ft. sand screws process the sand. In the pit, a ¾-cu. yd. Link-Belt shovel loads to GMC and Ford dump trucks. Washed sand and aggregates are stockpiled by trucks that unload near the toe of four separate piles, all built over individual truck-reclaiming tunnels. A Caterpillar D-6 and dozer then pushes the material up over the reclaiming tunnels.

Washed sand and gravel is delivered to the ready mixed concrete plant by company-owned trucks. The trucks discharge to one of four concrete truck hoppers, heated by gas-burner units, from which the material is reclaimed by an 18-in. belt conveyor via 12 clamshell type, hand-operated gates. Quite extensive arrangements have been provided to have plenty of hot water available during cold weather and to automatically blend this 220 deg. F. water with colder water to get temperatures compatible with the weather conditions at the time. A 50-hp. Spencer, gas-fired boiler with a circulating water system has been provided, so arranged that should cold weather occur during the night, when the plant is inactive, the boiler fires automatically. When the day shift starts there is plenty of hot water available.

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Truck dumping into hopper feeding primary crusher. Specially developed feeder shown below

Favorite Arias
from Famous Operas
CHANGES TO NEW TIME
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7:00 TO 7:30 O'CLOCK
ON
SATURDAY NIGHTS
WE CORDIALLY INVITE YOU TO LISTEN THIS SATURDAY NIGHT TO
DIE MEISTERSINGER
by
Richard Wagner
SINCERELY
M. Sundt
ALBUQUERQUE GRAVEL PRODUCTS CO.

Back of postal card sent out to interested radio listeners, announcing changes in radio time

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Pumice Block

(Continued from page 199)

plant in freight cars, is delivered to the storage silo over the batcher by a small bucket elevator.

The aggregates are batched to the mixers which in turn discharge to an overhead travelling dolly or carriage that rides parallel rails. By means of a small electric tugger the dolly can be placed over either the two Besser Vibrapacs or the Dunbrik machine. Incidentally, at time of inspection, the Besser machines were running full blast and producing 45,000 4- x 8- x 12-in. blocks per day and running 24 hours for six days a week. The Dunbrik machine has turned out as high as 60,000 brick per day. The smaller sized block are very popular in the area as few 8- x 8- x 16-in. block are sold. Perlite and perlite block are shipped over a wide area, some of the former going into Dallas and other points in East Texas.

Finished blocks from the machines are placed on steel racks and hauled into the steam kiln by two Elwell-Parker lift trucks. A power-Ox also is available for handling the block and brick.

At the Six-Point site, the company owns about 10 acres of ground most of which has been laid with a concrete pavement. A portion of this yard may later be used for fabricating precast roof slabs, joists, etc.

The company has a fleet of K-7 International trucks equipped with Fruehauf trailer extensions with a long wheel base and heavier axles. These trucks are all painted different colors; some are red and yellow, some black and white with the colors divided longitudinally through the center of the truck. This deviation from standard practice where all trucks are usually painted the same solid color has caused considerable comment in Phoenix and has been an excellent advertising media.

The company has a subsidiary organization operating under the name of the Premier Metal Products Corp. which is one of the largest manufacturers of aluminum windows in the United States. This concern distributes nationally through building material dealers, and receives its supply of aluminum from the Reynolds aluminum plant in Phoenix. The company's headquarters on N. Central Avenue is rapidly being converted into additional office space and for use as a building material and hardware retail sales outlet.

Officers of the company are Paul M. Thomas, president; Gilbert E. Olson, vice-president; and Roger C. Thomas, secretary.

Concrete Sewer Pipe

PHILADELPHIA, PENN., is now installing concrete sewer pipe for the first time in nearly 50 years, according to Thomas Buckley, public works director. The return to concrete pipe has been occasioned by the continuing shortages of tile or terra cotta and the scarcity of specialized bricklayers needed for laying up brick sewer conduits.

Plan Ready-Mix Plant

HURON CONCRETE PRODUCTS CO. recently announced its intention to operate a ready-mix plant. The company will operate its own delivery trucks: a three-yard and a one-yard, with delivery of an additional three-yard truck expected soon. The new plant represents an expenditure of approximately $25,000.

Enters Concrete Business

CECIL ATKINSON, connected with the Iowa Highway Commission for more than 17 years, is preparing to enter business for himself as a producer of concrete products and general concrete contracting.

Ready-Mix Plant Opens

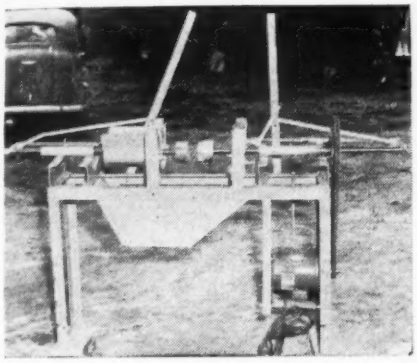
NOEL READY-MIX CONCRETE CO., Spencer, Ia., has officially opened its new plant for mixing and loading concrete. The company was incorporated for $50,000 earlier this year.

NEW MACHINERY

Concrete Tile Machine

WAGONER MANUFACTURING CO., Gibsonville, N. C., has developed a horizontal hollow tile machine which makes the tile with the material pressed to the boring bit and with pressure maintained until the boring bit completes the operation. It is claimed that a denser, harder and stronger tile is made by this process.

It is an all-steel, electrically welded machine. Moulds are placed in and removed from the top which makes it very easy and fast to operate. Material is scooped into the hopper on the right side; then the right hand lever forces material into the form. The left hand lever forces the boring head through the material which is maintained under pressure until the tile is finished. The boring head has three trowelling bits.



Machine for concrete tile

Two sizes of tile are made with this machine; 4-in. inside diameter, 12-in. long; and 6-in. inside diameter, 12-in. long. A ¾-hp. motor is recommended for the machine.

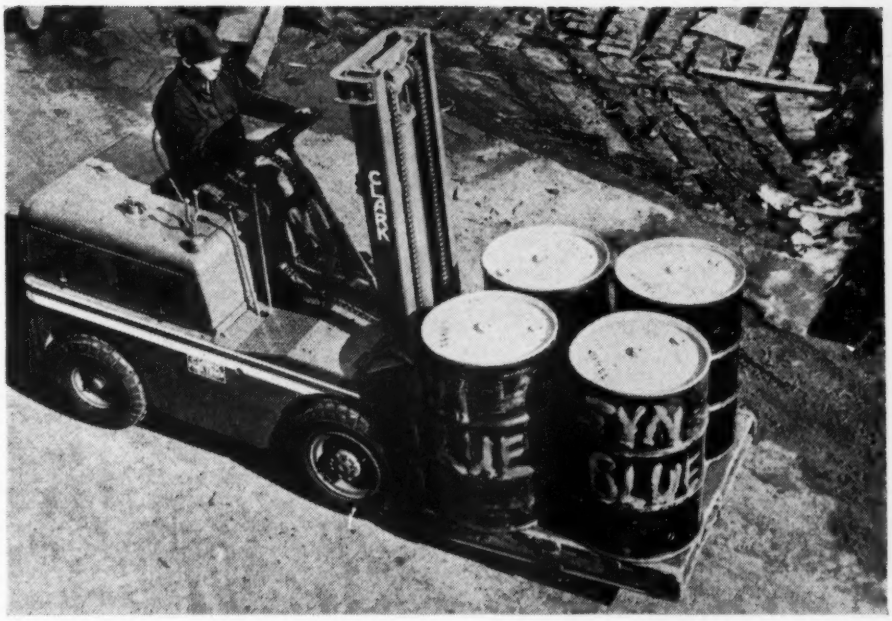
Tile-Finish Block

PLASTO PRODUCTS, INC., Allendale, N. J., a concrete block manufacturer, has developed a colored, plastic cement film for treating concrete block to give it a glass-like finish. A suburban home builder is now planning to use this type block in New Jersey, Long Island, and other New York suburbs. The material is applied to the block itself and cannot be placed on the finished wall.

John J. Gasko, describing the company's methods of construction with this new type block, advises that the greatest use is for hallways, lobbies, insides of stores, recreation rooms, gas stations, and show rooms. It is planned to sell the mixed material to manufacturers of block under license and show them how to apply it.

In laying up these block some masons prefer to use the conventional ¼-in. to ½-in. joint. However, it has been found that due to the slight taper in the block and the special molds which are perfectly square, there is about an ⅛ in. overlap of material on two sides of the block with the face being slightly larger than the back of the block. Keeping this in mind, the following method is used in laying a wall:

Less than ¼ in. of mortar is applied to the back top of the block with no mortar on the front top. The face of the block then have a very small joint, generally a 1/16-in. bead. Bonding is done by dropping some mortar into the cored holes, and as these holes are located half way across the ribs of the preceding row they form a regular "U" clamp in three places which gives an exceptionally strong wall and also can be quickly laid up. The face of the joints after the entire wall is constructed is filled in with white cement grout, mixed one part cement to two parts white sand. Mineral pigments to match the color of the blocks may be added. This face joint may be immediately wiped clean with a rag.



Pneumatically-tired lift truck for operation over uneven surfaces

Design Block Machine

Rowe's Block Co., Rolesville, N. C., started production of concrete masonry units in March, 1946, on a pair of vibrating type block machines designed and manufactured by B. T. Rowe, one of the brothers. The new machine, called the Rowe Twin Block Machine, is capable of producing 150 units per hour. Block cured in three steam rooms are stored outside for a suitable period before delivery. W. E. and B. T. Rowe are the owners.

Open Big Block Plant

ANCHOR CONCRETE PRODUCTS, INC., Cheektowago, N. Y., held formal opening of its new $350,000 plant on June 21 (see June ROCK PRODUCTS, p. 146, for full account of highly mechanized plant). Fred W. Reinhold, president, was host to 500 western New York building interests and national leaders in the concrete industry who attended the opening.

Pneumatic-Tired Fork Lift Trucks

CLARK TRUCTRACTOR, Division of Clark Equipment Co., Battle Creek, Mich., has brought out its "Yardlift-40" pneumatic-tired fork lift truck. Designed for working outdoors and on surfaces too uneven for solid tired machines, the new lift truck has a capacity of 4000 lbs. at 24 in.; has a lift of 120 in. with 85½-in. overall height.

This model has a pivoted steering axle mounting and a three-point suspension for smooth operation over uneven surfaces. A new type drive axle permits a 42-in. overall width and a high degree of maneuverability. A speed of 9.4 m.p.h. in high and 2.9 m.p.h. in low, both forward and reverse, is attained with the heavy-duty transmission.

Tire change is simple by removal of demountable rim secured by four lugbolts; and ample clearance has been provided for tire chains on the drive wheels, to facilitate all-weather operation. Minimum under clearance with the truck empty is 5¼-in. under the center of the drive axle.

Block Plant Mechanization

CUNARD-LANG, Columbus, Ohio, is contemplating the installation of an overhead aggregate and bulk cement bin system, with automatic Johnson weigh-batching hopper. Plans are also made for a new automatic boiler to deliver steam used in the kilns.

A new kiln of concrete block construction was completed earlier this year, with concrete slab roof topped with cinders for insulation and of 1,296 modular block capacity. High-early-strength portland cement is used and the blocks are left in the kiln for 24 hours, with live steam being admitted for the entire period. The blocks are then ready for delivery, meeting the recognized standards for compressive strength and absorption.

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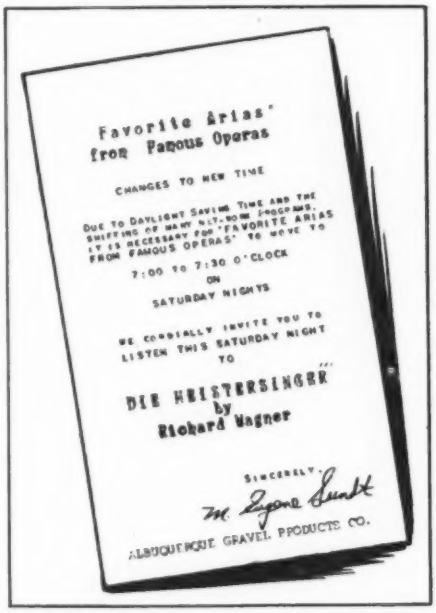
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(Continued from page 199)

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Finished blocks from the machines are placed on steel racks and hauled into the steam kiln by two Elwell-Parker lift trucks. A power-Ox also is available for handling the block and brick.

At the Six-Point site, the company owns about 10 acres of ground most of which has been laid with a concrete pavement. A portion of this yard may later be used for fabricating precast roof slabs, joists, etc.

The company has a fleet of K-7 International trucks equipped with Fruehauf trailer extensions with a long wheel base and heavier axles. These trucks are all painted different colors; some are red and yellow, some black and white with the colors divided longitudinally through the center of the truck. This deviation from standard practice where all trucks are usually painted the same solid color has caused considerable comment in Phoenix and has been an excellent advertising media.

The company has a subsidiary organization operating under the name of the Premier Metal Products Corp. which is one of the largest manufacturers of aluminum windows in the United States. This concern distributes nationally through building material dealers, and receives its supply of aluminum from the Reynolds aluminum plant in Phoenix. The company's headquarters on N. Central Avenue is rapidly being converted into additional office space and for use as a building material and hardware retail sales outlet.

Officers of the company are Paul M. Thomas, president; Gilbert E. Olson, vice-president; and Roger C. Thomas, secretary.

Concrete Sewer Pipe

PHILADELPHIA, PENN., is now installing concrete sewer pipe for the first time in nearly 50 years, according to Thomas Buckley, public works director. The return to concrete pipe has been occasioned by the continuing shortages of tile or terra cotta and the scarcity of specialized bricklayers needed for laying up brick sewer conduits.

Plan Ready-Mix Plant

HURON CONCRETE PRODUCTS CO. recently announced its intention to operate a ready-mix plant. The company will operate its own delivery trucks: a three-yard and a one-yard, with delivery of an additional three-yard truck expected soon. The new plant represents an expenditure of approximately $25,000.

Enters Concrete Business

CECIL ATKINSON, connected with the Iowa Highway Commission for more than 17 years, is preparing to enter business for himself as a producer of concrete products and general concrete contracting.

Ready-Mix Plant Opens

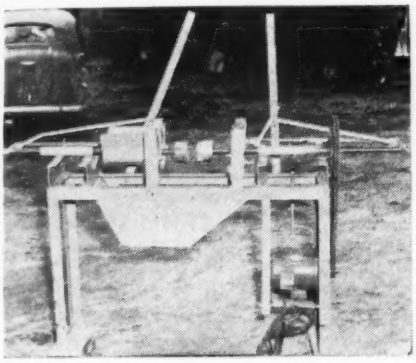
NOEL READY-MIX CONCRETE CO., Spencer, Ia., has officially opened its new plant for mixing and loading concrete. The company was incorporated for $50,000 earlier this year.

NEW MACHINERY

Concrete Tile Machine

WAGONER MANUFACTURING CO., Gibsonville, N. C., has developed a horizontal hollow tile machine which makes the tile with the material pressed to the boring bit and with pressure maintained until the boring bit completes the operation. It is claimed that a denser, harder and stronger tile is made by this process.

It is an all-steel, electrically welded machine. Moulds are placed in and removed from the top which makes it very easy and fast to operate. Material is scooped into the hopper on the right side; then the right hand lever forces material into the form. The left hand lever forces the boring head through the material which is maintained under pressure until the tile is finished. The boring head has three trowelling bits.



Machine for concrete tile

Two sizes of tile are made with this machine; 4-in. inside diameter, 12-in. long; and 6-in. inside diameter, 12-in. long. A ¾-hp. motor is recommended for the machine.

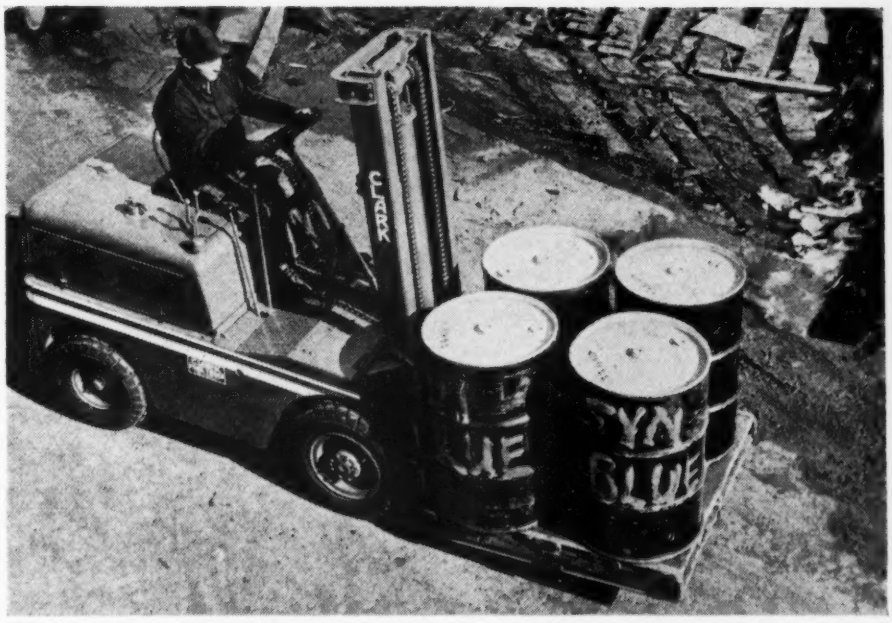
Tile-Finish Block

PLASTO PRODUCTS, INC., Allendale, N. J., a concrete block manufacturer, has developed a colored, plastic cement film for treating concrete block to give it a glass-like finish. A suburban home builder is now planning to use this type block in New Jersey, Long Island, and other New York suburbs. The material is applied to the block itself and cannot be placed on the finished wall.

John J. Gasko, describing the company's methods of construction with this new type block, advises that the greatest use is for hallways, lobbies, insides of stores, recreation rooms, gas stations, and show rooms. It is planned to sell the mixed material to manufacturers of block under license and show them how to apply it.

In laying up these block some masons prefer to use the conventional ¼-in. to ½-in. joint. However, it has been found that due to the slight taper in the block and the special molds which are perfectly square, there is about an ⅛ in. overlap of material on two sides of the block with the face being slightly larger than the back of the block. Keeping this in mind, the following method is used in laying a wall:

Less than ¼ in. of mortar is applied to the back top of the block with no mortar on the front top. The face of the block then have a very small joint, generally a 1/16-in. bead. Bonding is done by dropping some mortar into the cored holes, and as these holes are located half way across the ribs of the preceding row they form a regular "U" clamp in three places which gives an exceptionally strong wall and also can be quickly laid up. The face of the joints after the entire wall is constructed is filled in with white cement grout, mixed one part cement to two parts white sand. Mineral pigments to match the color of the blocks may be added. This face joint may be immediately wiped clean with a rag.



Pneumatically-tired lift truck for operation over uneven surfaces

Design Block Machine

Rowe's Block Co., Rolesville, N. C., started production of concrete masonry units in March, 1946, on a pair of vibrating type block machines designed and manufactured by B. T. Rowe, one of the brothers. The new machine, called the Rowe Twin Block Machine, is capable of producing 150 units per hour. Block cured in three steam rooms are stored outside for a suitable period before delivery. W. E. and B. T. Rowe are the owners.

Open Big Block Plant

ANCHOR CONCRETE PRODUCTS, INC., Cheektowago, N. Y., held formal opening of its new $350,000 plant on June 21 (see June ROCK PRODUCTS, p. 146, for full account of highly mechanized plant). Fred W. Reinhold, president, was host to 500 western New York building interests and national leaders in the concrete industry who attended the opening.

Pneumatic-Tired Fork Lift Trucks

CLARK TRUCTRACTOR, Division of Clark Equipment Co., Battle Creek, Mich., has brought out its "Yardlift-40" pneumatic-tired fork lift truck. Designed for working outdoors and on surfaces too uneven for solid tired machines, the new lift truck has a capacity of 4000 lbs. at 24 in.; has a lift of 120 in. with 85½-in. overall height.

This model has a pivoted steering axle mounting and a three-point suspension for smooth operation over uneven surfaces. A new type drive axle permits a 42-in. overall width and a high degree of maneuverability. A speed of 9.4 m.p.h. in high and 2.9 m.p.h. in low, both forward and reverse, is attained with the heavy-duty transmission.

Tire change is simple by removal of demountable rim secured by four lugbolts; and ample clearance has been provided for tire chains on the drive wheels, to facilitate all-weather operation. Minimum under clearance with the truck empty is 5¼-in. under the center of the drive axle.

Block Plant Mechanization

CUNARD-LANG, Columbus, Ohio, is contemplating the installation of an overhead aggregate and bulk cement bin system, with automatic Johnson weigh-batching hopper. Plans are also made for a new automatic boiler to deliver steam used in the kilns.

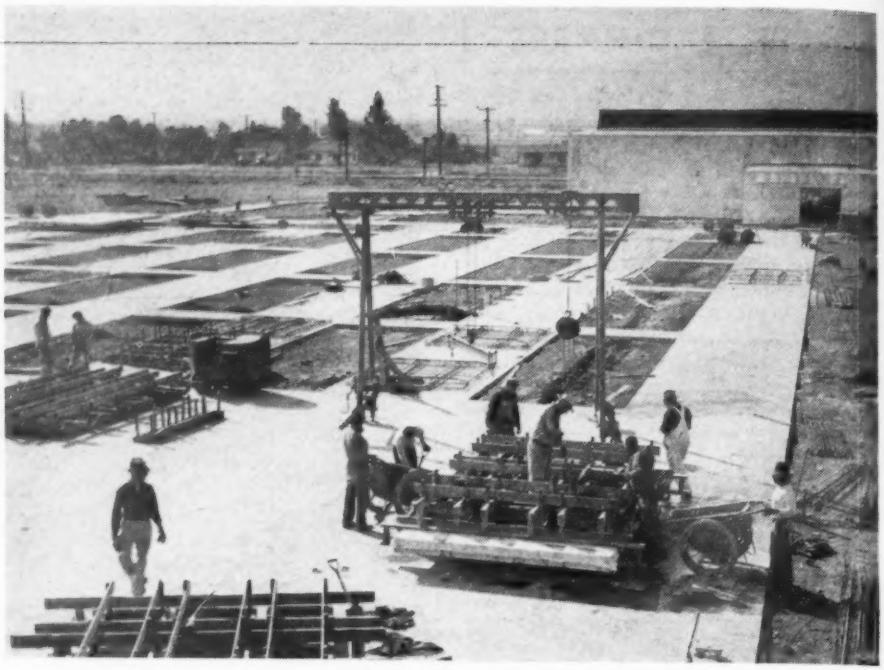
A new kiln of concrete block construction was completed earlier this year, with concrete slab roof topped with cinders for insulation and of 1,296 modular block capacity. High-early-strength portland cement is used and the blocks are left in the kiln for 24 hours, with live steam being admitted for the entire period. The blocks are then ready for delivery, meeting the recognized standards for compressive strength and absorption.

Precast

Building Houses Using Large Precast Sections

Normac, Inc., Los Angeles, Calif., constructing large number of buildings with precast concrete walls, roofs and partitions

By WALTER B. LENHART



Workmen completing one of 200 casting tables for the precast concrete house sections. In the background is building housing the assembly and casting line

THERE are three directions that the concrete masonry production methods can take: First, there is that group that think the industry will gradually drift into strong hands, with large plants strategically located so as to serve a considerable area with a low cost building block. There is a second group that looks towards the other extreme wherein small, light, compact plants that can either be loaded on a pick-up or wheeled to a construction site and the blocks made at the place of use. The third path that the industry could follow is the pre-casting of large sections of a house or business building and because these sections may be too large and heavy to handle by the small contractor, the manufacturer of these large concrete units may erect the building with his own equipment. An example in the third category is Normac, Inc., Los Angeles, Calif., with a large plant on a 10-acre site at Puente, near Los Angeles.

The company was organized by E. S. McKittrick, a well known contractor in California, and with him is associated John K. Northrop of aviation fame. To date they have invested about $500,000 in their venture at Puente. The company's name is formed from the two owner's names.

Basically the Normac pre-cast home method is based on the casting of

Roof section being moved into position

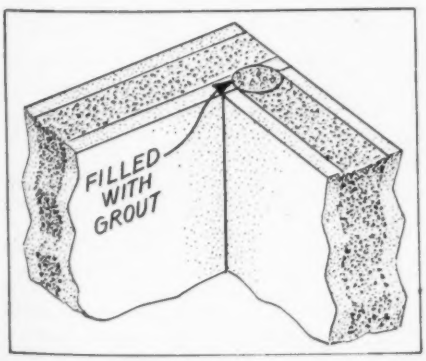
Wall section being moved into place

large slabs of reinforced concrete. These slabs, which may be large enough to form one side of a room, are cast with aluminum window and door casings embedded in the concrete.

As the slabs are cast flat, using a suitable bedding, the finished slab has a matte appearance that is quite pleasing to the eye, and in most cases this surface needs no further treatment. The slabs are made up like a sandwich: first, a layer of 4000-lb. concrete, then a core of lightweight concrete, and finally another layer of standard concrete. Perlite, the aggregate, is an artificial, lightweight aggregate produced from a volcanic rock. Normac, Inc., obtains its supply from the new plant at Torrence, Calif., operated by the Great Lakes Carbon Corp. The final wall has excellent insulating properties both against heat and cold. One of the company's first orders was for a considerable number of homes to be built at Trona, Calif., out on the desert where heat conditions are very severe.

The plant at Puente has a capacity of four houses per day with each house requiring (on an average) of about 36 slabs per house. This includes all exterior walls, roof, and partitions. At present five different designs are available; two 2-bedroom houses, two 3-bedroom, and one 1-bedroom house, but the engineering staff is rapidly expanding this department. Each house, which has from 600 to 1140 sq. ft. of floor area, is erected complete with all plumbing and lights, etc., by Normac, Inc., for from $5200 to $9200 which includes one- or two-car garages. The house is all-concrete; floor, roof and walls. Many of the features are patented. At the plant a Noble batcher is used to speed up production.

In building a house by this method, the floor is first cast of concrete, leaving a longitudinal recess at all walls which is the same width as the partition's thickness (6 in.), with suitable vertical stub reinforcings. The wall section is then lifted into place and grouted. Corners are made up by a special pre-cast, tubular opening, as shown in the illustration, which is filled with grout. The roof slabs are designed so that they can be placed on top of the wall sections and grouted into position without fear or danger of side movements. The roofs are perfectly flat and are covered with a 15 lb. tar-felt roofing preparation.



Cross section showing how sections are tied together with cement grout

Exterior layer or "skin" of concrete house section is reinforced with steel on 6 in. centers

To date Normac, Inc., plans only to build houses in groups of large to medium sized housing projects due to the cost of moving the large truck crane to the construction site, but eventually they plan to build homes in any locality served by the plant. They have established a time-table of 90 days for the completion of a home—ready to move into. Outside walls are covered with a water-proofing paint. All electrical conduits are cast in the walls.

Officers of the company are: E. S. McKittrick, president; R. E. Duba, vice-president; F. Sweeney Tuck, chief engineer; B. J. Coyne, purchasing agent; Adolph Brant, construction manager; and Don Slaybaugh, secretary.

Concrete Vault Association Holds Three-Day Meeting

APPROXIMATELY 150 members and guests attended the 20th Annual convention of the National Concrete Burial Vault Association, held July 1st to 3rd at the Royal York Hotel, Toronto, Canada. E. N. Johnson, president, Pittsburgh, Penn., dispensed with the usual president's message in order to devote more time to the full program prepared by the convention's host, Kenneth Hansford, Toronto.

One of the featured events was a plant demonstration held at the Toronto Concrete Burial Vault Co., Ltd. The entire manufacturing operations of stripping forms, casting concrete in molds, operation of lift trucks, use of steam curing kilns, finishing and storage of vaults were supervised and explained by S. H. Westby, Portland Cement Association.

Following the plant demonstration, an inspection was made of Mr. Hansford's new Toronto plant where he exhibited unique truck and cemetery equipment. A vault having a special "suede" finish designed for the luxury trade was also shown.

An illustrated address on Good Concrete for Burial Vaults, stressing durability and watertightness as well as strength, was presented by S. H. Westby, the group's technical adviser. G. Page Hereford, St. Louis, acted as moderator in a panel discussion on Solve Your Problem. Suggestions on money and time saving equipment and methods had been submitted by the members in a contest for cash awards. First prize was won by Dewey King, Danvers, Mass., for a cover rod-handle bender. Second prize was awarded to H. O. Swingle, Scranton, Penn., for a cover racking device. R. Casey received third prize for a light rubber tired cover dolly.

An address and movie on the use of lift trucks in vault plants was presented by M. L. Crawford, Clark Equipment Corporation.

The first day was fittingly closed with an outdoor barbecue, presided over by Miss Toronto as hostess. The annual banquet and ball, held in the Royal York ballroom on the night of the last day, was well attended and served as a fitting climax to the convention's activities.

Officers elected to serve for the coming year are: President, Paul Keating, Springfield, Mass.; vice-president, H. O. Swingle, Scranton, Penn.; and secretary-treasurer, J. R. Van Meter, Cincinnati, Ohio.

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Concrete Products Output Summerized for 1946

CONCRETE BLOCK OUTPUT in the United States reached a figure of over 940 million units of 8- x 8- x 16-in. equivalent for 1946, or more than double the 1945 production. Concrete brick manufacture during the same year was three and one-half times that of 1945, or 218 million standard units. There were almost 3,800 plants (employing one or more wage earners) in operation at some time during the year.

Concrete Brick (1946 Total)

State	Production*	No. of Plants
Total U. S.	218,167	500
Georgia	21,104	23
Ohio	19,202	18
Florida	16,576	34
California	10,701	59
Alabama	10,435	14

*Production in thousands of standard brick.

The foregoing figures have been abstracted from a full release that summarizes the statistics for concrete masonry output, quarterly, from the third quarter of 1944 through 1946. It is the first time such complete information covering the whole industry and for the entire period has been brought together in one place. The release is titled: Facts for Industry Series M26C-4-6, prepared by the Bureau of the Census, Industry Division, Mineral Industries Section.

TOTAL 1946 BLOCK PRODUCTION (BY TYPE)

Lightweight Aggregate

State	Production*	No. of Plants
Total U. S.	386,389	1,573
Pennsylvania	46,271	116
New Jersey	35,478	108
New York	32,002	87
Ohio	31,125	74
Michigan	21,786	91

Heavyweight Aggregate

State	Production*	No. of Plants
Total U. S.	553,718	2,817
Michigan	58,679	242
Ohio	48,552	189
Pennsylvania	39,480	118
Florida	33,716	111
Illinois	26,427	151

*Production in thousands of 8- x 8- x 16-in. block equivalent.

The peak, both in number of units produced and in number of active plants, was reached in the third quarter of 1946. During this three-month period, 284 million block and 69 million brick were produced by 3,474 active plants. Pennsylvania ranked first as a producer of concrete block during 1946, followed by Michigan, Ohio, New York and New Jersey. Block production per plant in the United States averaged 84,000 8- x 8- x 16-in. block in the third quarter of the year.

The smaller plants consistently produced more heavyweight aggregate block, while the larger plants leaned more to the lightweight block. The figures for the third quarter of 1946 show, graphically, this line of demarcation:

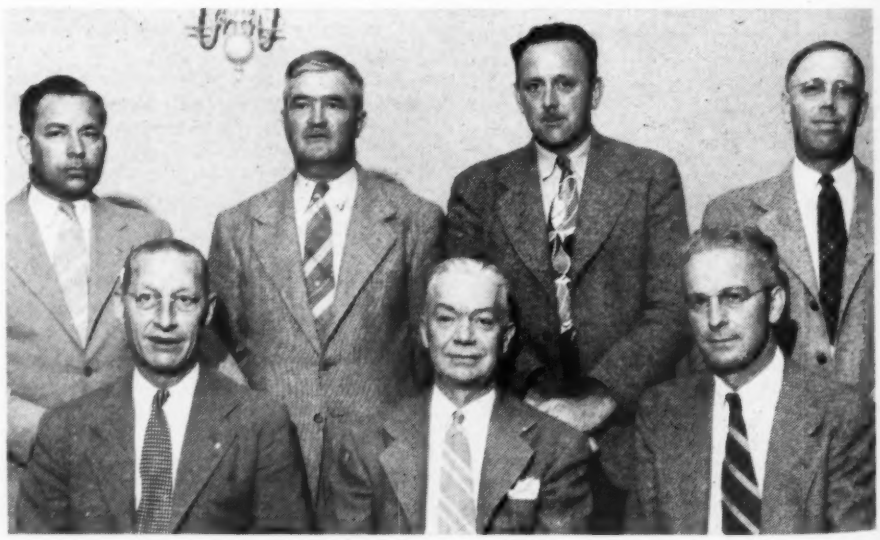
Number of block produced in period*	No. of plants	Lightweight aggregate*	Heavyweight aggregate*
Up to 499	3,287	68,062	135,252
500 to 1000 and over	100	47,331	33,549

Start Block Plant

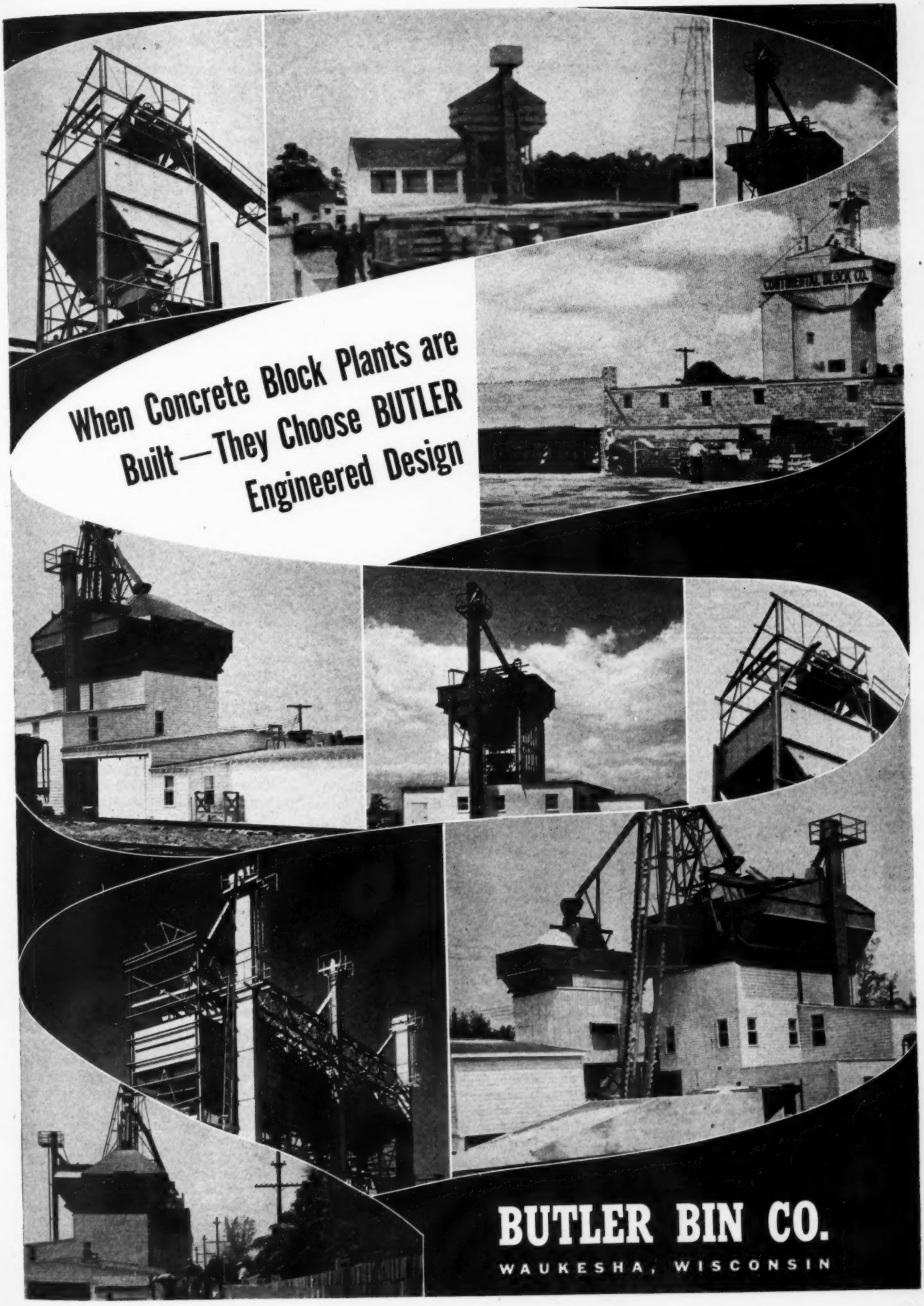
ANCHOR CONCRETE PRODUCTS, Allendale, S. C., started operations recently. The plant has a capacity of 15,000 concrete brick per day plus 1,600 concrete block. The owners, Mr. Jones and son, plan to install a second block machine in the immediate future.

Pumice Plant

B. F. AND D. O. CRAIG have announced their intention to build a new pumice plant at Toppenish, Ore. The brothers were formerly of Pineville. Two lots next to the Graham-Morris Ready-Mix plant have been acquired.



New officers and directors of the National Concrete Burial Vault Association. Left to right, back row: Calvin Bell, Bell Wilbert Vault and Monument Works, Miamisburg, Ohio; Dewey King, King-Norwalk Vault Co., Danvers, Mass.; Kenneth Hansford, Toronto Concrete Burial Vault Co., Ltd., Toronto, Canada; William Fithian, Fithian Cement Products Co., Youngstown, Ohio. Left to right, bottom row: vice-president, H. O. Swingle, Scranton Burial Vault Co., Scranton, Penn.; secretary-treasurer, J. R. Van Meter, Cincinnati, Ohio; president, Paul Keating, Keating Wilbert Vault Co., Springfield, Mass. W. E. Hollingsworth, Vault Service, Inc., Princeton, Ind., also a member of the board of directors, was not present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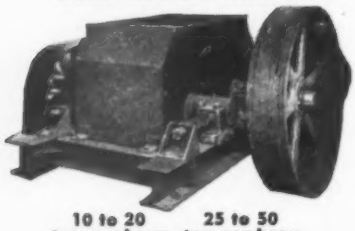

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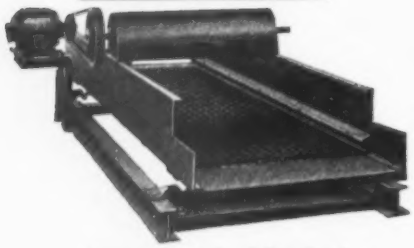

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724 Salem Avenue, Elizabeth 3, N. J.

What Size Truck Chassis for Ready Mix Haulage?

By HARRY F. THOMSON*

IN MOST METROPOLITAN AREAS the largest volume of ready mixed concrete is furnished within the central city itself; however, with growing decentralization and with the current emphasis on housing construction, a larger portion of deliveries than formerly are going into outlying or suburban, and in many localities, even rural areas. Circumstances which may place limits on the size and weight of truck equipment vary widely; thus an operation in Manhattan Borough of New York City will deliver almost exclusively within the city and will be governed by such limitations as the city imposes, but an operation in St. Louis with its very confined city limits will serve many jobs in the surrounding suburbs, which frequently do not adopt specific limitations but are satisfied to state that the "state regulations will apply."

Usual state regulations with reference to length, width, and height of truck are not at present a handicap to this industry. Trucks used are either the conventional two-axle or the three-axle tandem-drive type, with about 48 in. between the rear axles; in either type, the length would not exceed 22 ft. The usual width limitation of 96 in. does not affect any but the very largest equipment, although mixer trucks with 96-in. drums are now in service. The height of the largest present trucks is under 12 ft., and therefore well within usual limits.

Weight limitations, on the other hand, frequently represent a severe handicap on the efficient operation of this industry. A common limit of weight on any single axle is 18,000 lb., provided requirements as to tire width and gross weight in proportion to distance between front and rear axles are met. Balloon tire sizes will usually insure sufficient width, and the permissible gross weight determined by the formula $650(L+40)$ is usually greater for conventional trucks than permitted by the axle weight limitations. Thus for a two-axle truck with 18,000 lb. on the rear axle and approximately 6,000 lb. on the front axle (which is higher than customary), the permissible gross weight would be only 24,000 lb., regardless of what the formula says. After allowing for a typical weight of revolving-drum body, the maximum legal capacity of this truck would be only about 2¾-cu. yd. of concrete. Also, for a tandem, three-axle truck, the weight commonly allowed on the tandem pair of axles is 28,000 to 32,000 lb.; and the allowable capacity would be approximately 4½ to 5 cu. yds. of concrete.

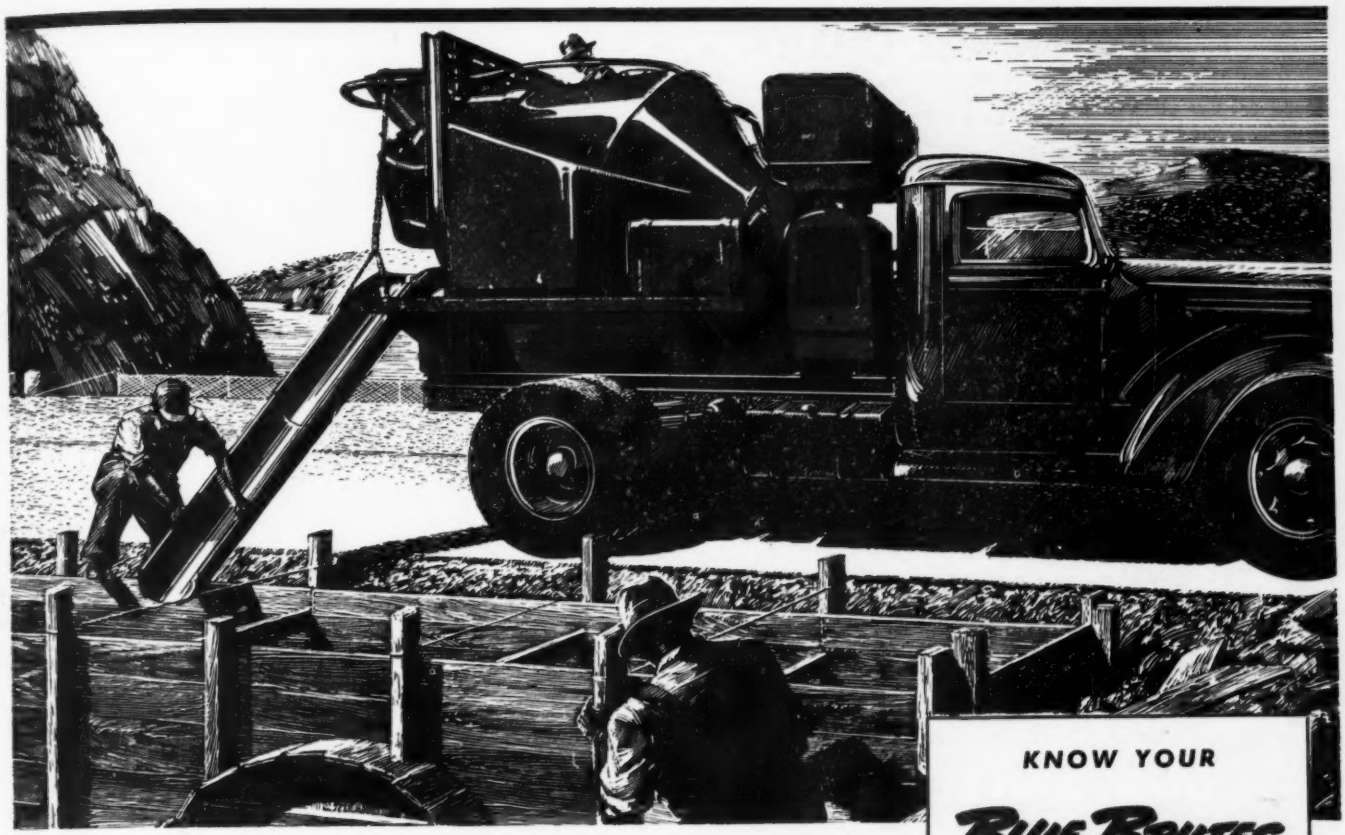
These are typical capacity loads of concrete under present weight regulations in many states, namely; 2¾ to 3 cu. yds. in a two-axle truck and 4½ to 5 cu. yds. in a three-axle truck. A few state regulations at present permit slightly larger loads, but only slightly. It will be noted that these load capacities represent a significant increase in truck weight over the typical load of 2 cu. yds. which was commonly handled only about 10 years ago. A majority of ready-mixed concrete operations are now using trucks of sizes for loading at substantially these capacities; but many are using trucks which will carry loads considerably in excess of these limitations.

Examination of data received in recent correspondence and submitted in the study of requirements for chasses in this industry which is being conducted by the National Ready Mixed Concrete Association, shows some startling facts regarding larger equipment now in service in various cities. Thus there are three-axle trucks hauling 8 cu. yds. of concrete and having a gross vehicle weight of 62,000 lb.; also two-axle trucks hauling 7 cu. yds. and having a gross vehicle weight of 58,000 lb. A tabulation of reports shows other instances of 3-axle units weighing 52,000 lb., 51,000 lb., 46,000 lb. and 45,000 lb., respectively. Random reports for two-axle trucks show gross weights of 48,000 lb., 37,000 lb., 36,000 lb., and 31,000 lb., respectively.

These weights are not cited as indicating wide-spread intent in the concrete industry to operate heavy equipment illegally. These trucks are all being used in large-city areas where weights considerably in excess of the respective state limitations are permitted. Inquiries of the operators of these heavy units reveal a conclusion that the size of load for most economical delivery of concrete under their respective conditions lies between 4½ and 6½ cu. yds; i.e., in general above the weight limitation imposed in most states upon even three-axle trucks. The fact of reduced traffic congestion resulting from using only two-thirds as many truck units of large size in a downtown area as would be necessary with smaller equipment, is also offered as a justification for these very heavy trucks. In most cases there is undoubtedly frequent occasion, if the weight regulations permitted, to operate these same heavy trucks outside the central city boundaries.

*From an address by Mr. Thomson, vice-president, General Material Co., St. Louis, Mo., before the recent annual meeting of the American Road Builders Association in Chicago.

HI-UP... IN NAME, REPUTATION AND QUALITY



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Worthington Pump and Machinery Corporation, Worthington-Ransome Construction Equipment Division, Holyoke, Mass.

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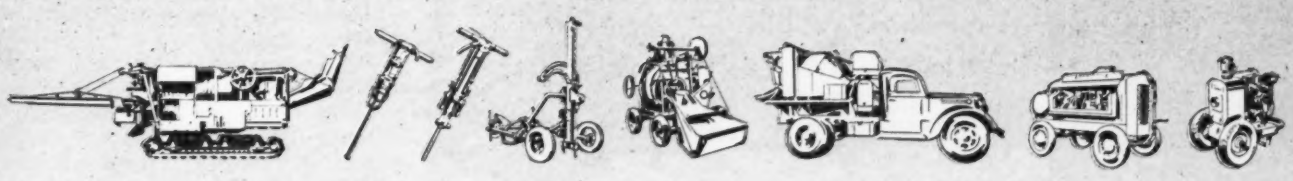

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A GRAVELEY BETTER-BUILT COMPLETE BLOCK PLANT FOR

Producing 125 Standard Block Per Hour
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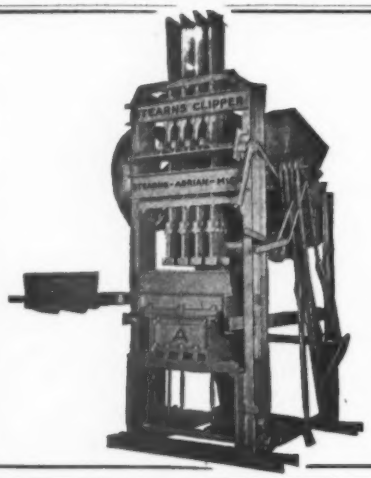

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Complete equipment for making concrete, cinder and other light weight aggregate units, including engineering service for plants and revamping of old ones for more economical service. Stearns Clipper Stripper Machines, Stearns Joltcrete Machines; Stearns Mixers; cast Iron and Press Steel Pallets. Straublox Oscillating Attachments, etc.

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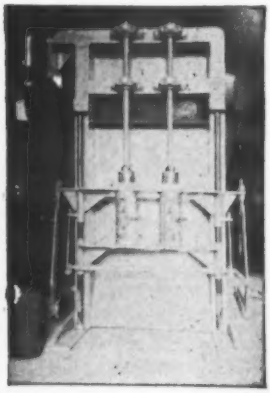

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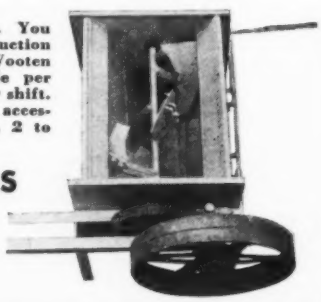

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Sturdily Built in Any Size To Meet Your Production Requirements. 9 Cu. Ft. Mixer $375.

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Concrete Products News

AURORA CONCRETE PRODUCTS CO., Wichita, Kans., has been purchased by Cecil Jones and Robert McElwee.

HOMER MARTIN, Point Pleasant, Ohio, has opened a concrete block and ready mixed concrete plant.

W. L. AND C. F. ALBERS who have been operating a cinder block plant in Garden City, Kans., have moved the equipment to Scott City, Kans., and will operate there.

CONCRETE PRODUCTS CO., Fort Wayne, Ind., has started producing concrete block. Robert and Norman Buddle, brothers, are owners of the plant.

BUTLER BLOCK CO., Butler, Wis., has started the manufacture of concrete block and plans to produce concrete bathtubs, sinks, window sills, laundry tubs, etc. Jack Pollack, veteran, is owner of the plant.

NEWBURGH CONCRETE BLOCK CO., Newburgh, N. Y., operated by five veterans, is producing concrete block at the rate of 2000 block per day.

JAMES WALKER has opened a concrete block plant in Monticello, Minn., under the name of the Monticello Concrete Products Co.

ED HINTSALA, Jack Kampsula and August Johnson have started a concrete block manufacturing plant in Mills, Minn.

GERALD D. BOYD of Wagner, S. D., has established a concrete block plant in Lennox, S. D. He has a similar plant in Wagner in partnership with his brother.

HERMAN WRASSE, Milbank, S. D., is now producing concrete block at Ree Heights, S. D.

DEERWOOD BLOCK FACTORY, Deerwood, Minn., is now operating at full capacity. Hjalmer Hogstrom and sons are owners of the plant.

ROBERT C. MISHEK has purchased a concrete block plant in Waseca, Minn.

REYNAUD BLOCK & VENEER STONE CO., Monett, Mo., has opened a concrete block plant for the manufacture of veneer stone which is a finished concrete block resembling Carthage stone. It is also planned to produce ceramics with Morris E. Conkling in charge. Milton J. Reynaud is owner and manager of the plant and R. W. Adams is plant foreman.

NELSON & RAVENHORST CONCRETE PRODUCTS CO., Albert Lea, Minn., is manufacturing concrete tile in addition to concrete block.

WARREN CEMENT PRODUCTS, Warren, Minn., is the name of a new concrete block plant operated by Joe Urbaniak. Capacity of the plant is 200 block per hour.

SUN PRAIRIE READY-MIX, INC., Sun Prairie, Wis., has been incorporated to deal in ready mixed concrete and building supplies. Capital stock is $30,000, divided into 300 shares of $100 each. Incorporators are Henry Schasse and Robert Sumnicht, Madison, and Frank Stegerwald, Sun Prairie.

FOSTORIA CONCRETE PRODUCTS CO., Fostoria, Ohio, is manufacturing a new type of concrete block at the rate of 6000 block per day on a block machine designed and patented by James R. McComas and Simon Brenner. Bob Rankin and Art Miller are owners of the plant.

ERVIN KAWALSKE has announced the establishment of a concrete block plant in Wisconsin Rapids, Wis., to be known as the Tri-City Cement Block Co.

M. R. HAMILTON of Toledo, Ohio, and Dr. A. J. Hamilton of Detroit, Mich., have started erection of a concrete tile plant in Welcome, Minn.

CHISHOLM CONCRETE BLOCK CO., Chisholm, Minn., is manufacturing concrete block at the rate of 1000 block per day. Dario Rolle, veteran, is owner of the plant.

PHILLIPS BROTHERS CONCRETE WORKS, Benton, Ill., has opened a concrete block plant in Benton.

SUREWAY CONCRETE PRODUCTS CO., Bellingham, Wash., was purchased recently by Hilbert Kok and Dewey Vander Stoep, who have moved the manufacturing facilities to a new and larger location. Under the new management, the firm will specialize in a water-repellent concrete block.

CONCRETE PRODUCTS CO., Pine City, Minn., owned and operated by Al Kubat, has installed new block manufacturing equipment. The company's block is tested periodically by the Twin City Testing and Engineering Laboratory, according to Mr. Kubat.

LESTER PRAIRIE CEMENT TILE AND BLOCK CO. has been purchased by Elmer Schwartz and Donald Splettstazer from Mrs. Donald Druckenbrod. The new owners plan to expand the present plant and operate it on a year round basis.

L AND K CEMENT CO., Floodwood, Minn., plans to start construction of a 1500 block per day plant, according to Ed Luoma and Aldrick Kivela, the principles.

ED VAN BEEK is planning to open a concrete block factory in Linton, N. D., with an estimated capacity of 1000 block daily.

HATTING CONCRETE BLOCK AND TILE CO., Luverne, Minn., has begun production of concrete block. Tile making machinery is to be installed soon and a kiln will be added at some later date. The total investment is expected to amount to approximately $17,000 when completed.

VERNON POLLY AND FRANCIS RYAN have entered a partnership for the production of concrete block in their plant at Waupaca, Wis. The factory is equipped with a Universal Concrete Machinery Co. block machine capable of making either 8- or 10-in. block, with a capacity of up to 1500 block daily.

LATTA BROOK SAND & GRAVEL CORP., Elmira, N. Y., recently announced opening of a modern block plant at Big Flats, N. Y., for the production

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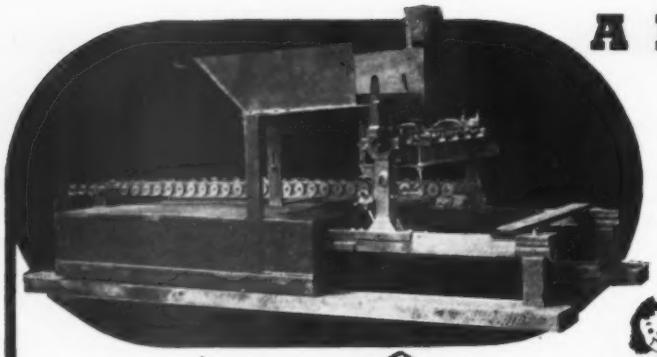

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with the New

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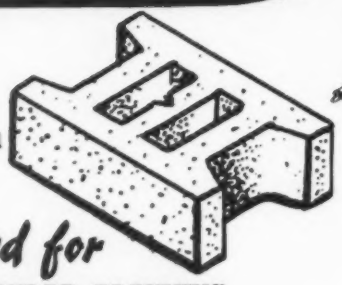

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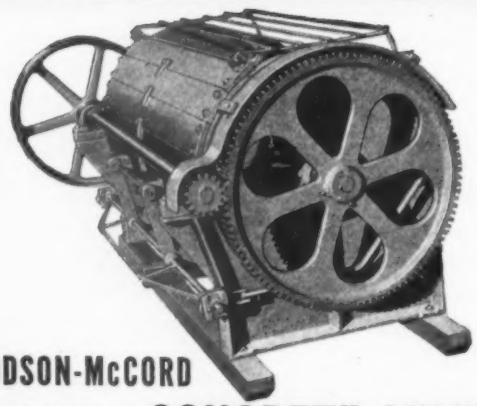

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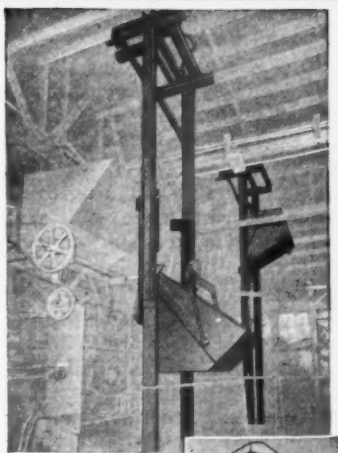

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